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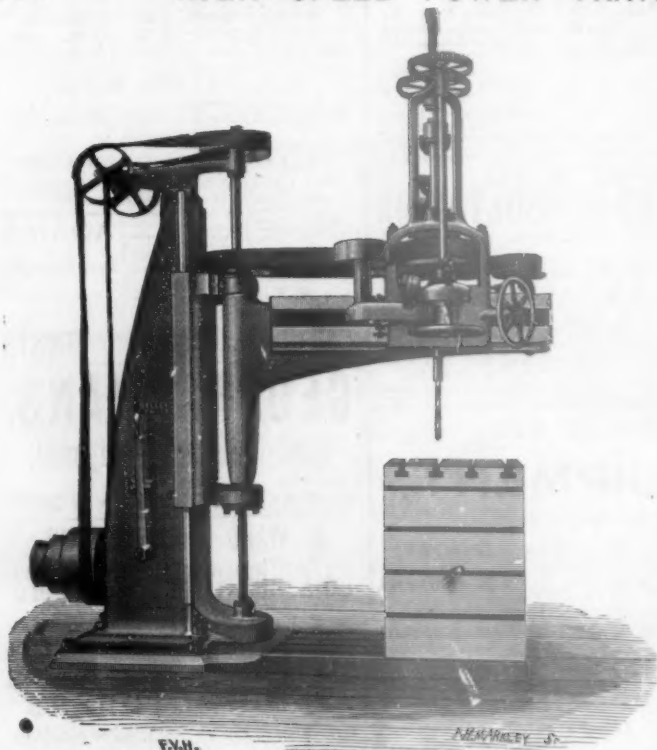
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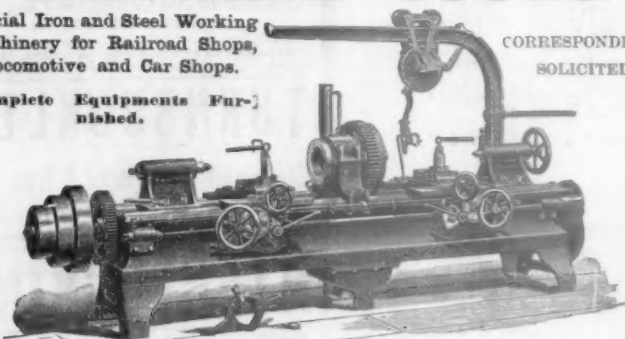
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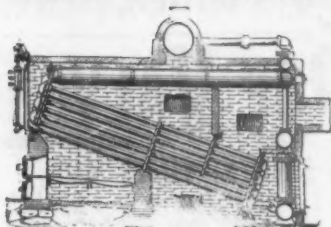
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I have, therefore, issued orders removing all restrictions as to the use of cars equipped with your brakes; and, hereafter, cars so equipped will be received and operated by this Company and treated precisely the same as the cars equipped with the Westinghouse Brake.

Yours very truly,
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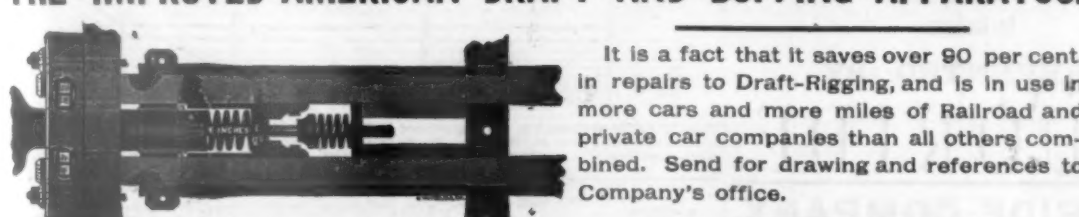
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ALPHABETICAL INDEX TO ADVERTISEMENTS.

Classified Index on the next page.

Adams, Oliver	1	Central Oil & Supply Co.	31	Fontaine Crossing Co.	34	Laidlaw & Dunn Co.	10	Otis Brothers & Co.	10	Smith, F. H.	13
Adams & Westlake Co.	1	Chester Steel Castings Co.	42	Foot Mfg. Co.	9	Lake, J. H. & D.	15	Paine, Chas. & Sons	12	Solid Steel Co.	27
Adams & Westlake Co.	1	Chicago Bridge & Iron Co.	20	Foster Engineering Co.	15	L. S. & M. S. R. R.	35	Parsons, W. B.	1	South Baltimore Car Works	26
Adams & Westlake Co.	1	C. B. & R. R.	15	French Spring Co.	20	Lehigh Valley Cream's Wks.	12	Passaic Rolling Mill Co.	37	South Baltimore Car Works	26
Adams & Westlake Co.	1	C. C. C. & St. L. Ry.	15	Frederick & Ayer	2	Lehigh Valley R. R.	27	Pennsylvania R. R.	47	Spon, E. & F. N. & Co.	17
Adams & Westlake Co.	1	C. H. & D. Ry.	20	Fuller Bros. & Co.	38	Leonard, H. Ward & Co.	1	Pennsylvania Steel Co., N. Y.	1	Springfield Emery Wheel Co.	7
Adams & Westlake Co.	1	C. M. & St. P. Ry.	20	Gardner, O. K.	2	Lidgerwood Mfg. Co.	2	Pennsylvania Steel Co., Pa.	47	Springfield Iron Co.	25
Adams & Westlake Co.	1	C. R. I. & P. Ry.	12	Gardner & Co. B. B.	12	Lime Machine Works	38	Philadelphia Bridge Wks.	38	Standard Steel Works	31
Adams & Westlake Co.	1	Chicago & Alton R. R.	20	Gates Iron Works	41	Link Belt Engineering Co.	15	Philadelphia & Reading R. R.	15	Standard Thermometer Co.	7
Adams & Westlake Co.	1	Chicago & N. W. Ry.	20	Gilbert, Bradford L.	1	Lodbell Car Wheel Co.	31	Phillips, William H.	24	Stiles & Parker Press Co.	8
Adams & Westlake Co.	1	Chicago & N. W. Ry.	20	Gilbert, Bradford L.	1	Long & Alstatter Co.	31	Phonix Bridge Co.	39	Stonington Line	41
Adams & Westlake Co.	1	Cleveland City Forge & Iron Co.	12	Gilbert, Bradford L.	1	Louis, Bridge & Iron Wks.	41	Phosph. Brse Smelt. Co., Ltd.	8	Stow Flexible Shaft Co.	40
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Adams & Westlake Co.	1	Connelly, J. T.	32	Gilbert, Bradford L.	1	Manning, Maxwell & Moore	10	Pittsburgh Loco. & Car Wks.	37	Tanite Co.	42
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Adams & Westlake Co.	1	Detroit Lubricator Co.	15	Gilbert, Bradford L.	1	McClure, Alex.	41	Rand Drill Co.	17	Vulcan Iron Works (Toledo)	17
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Adams & Westlake Co.	1	Dixson Crucible Co., Jos.	16	Gilbert, Bradford L.	1	McClure, Alex.	41	Rand Drill Co.	17	Wants and For Sale	13
Adams & Westlake Co.	1	Drexel Ry. Supply Co.	30	Gilbert, Bradford L.	1	McClure, Alex.	41	Rand Drill Co.	17	Washburn Car Wheel Co.	38
Adams & Westlake Co.	1	Dudgum, Richard	9	Gilbert, Bradford L.	1	McClure, Alex.	41	Rand Drill Co.	17	Wason Mfg. Co.	9
Adams & Westlake Co.	1	Dudley & Co., W. W.	12	Gilbert, Bradford L.	1	McClure, Alex.	41	Rand Drill Co.	17	Watson & Stillman	9
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Adams & Westlake Co.	1	Elmira Bridge Co.	36	Gilbert, Bradford L.	1	McClure, Alex.	41	Rand Drill Co.	17	Whitpool Water Purifier Co.	10
Adams & Westlake Co.	1	Employment	13	Gilbert, Bradford L.	1	McClure, Alex.	41	Rand Drill Co.	17	Whitpool Water Purifier Co.	10
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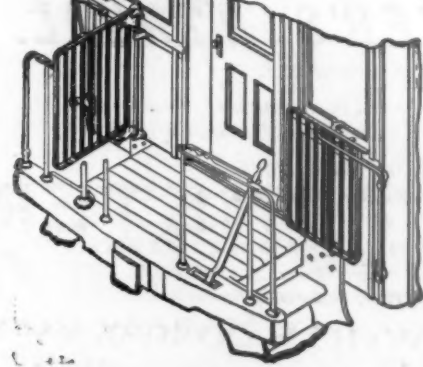
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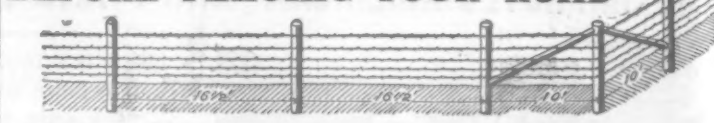
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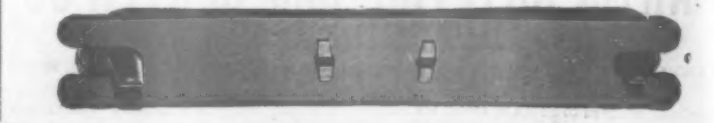
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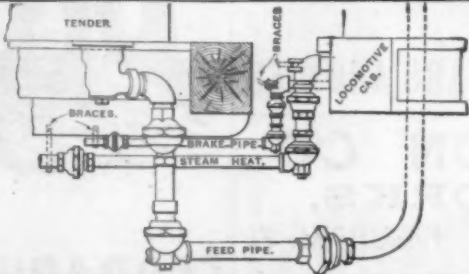
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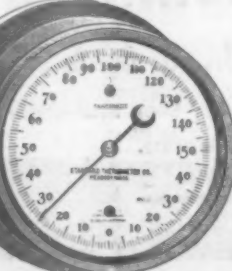
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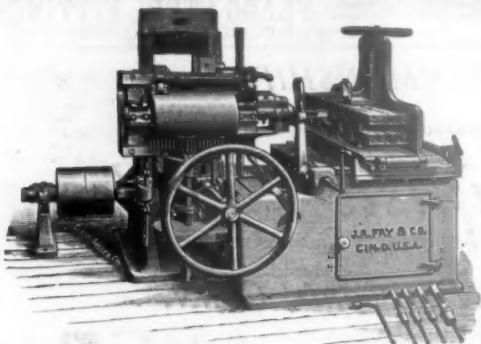
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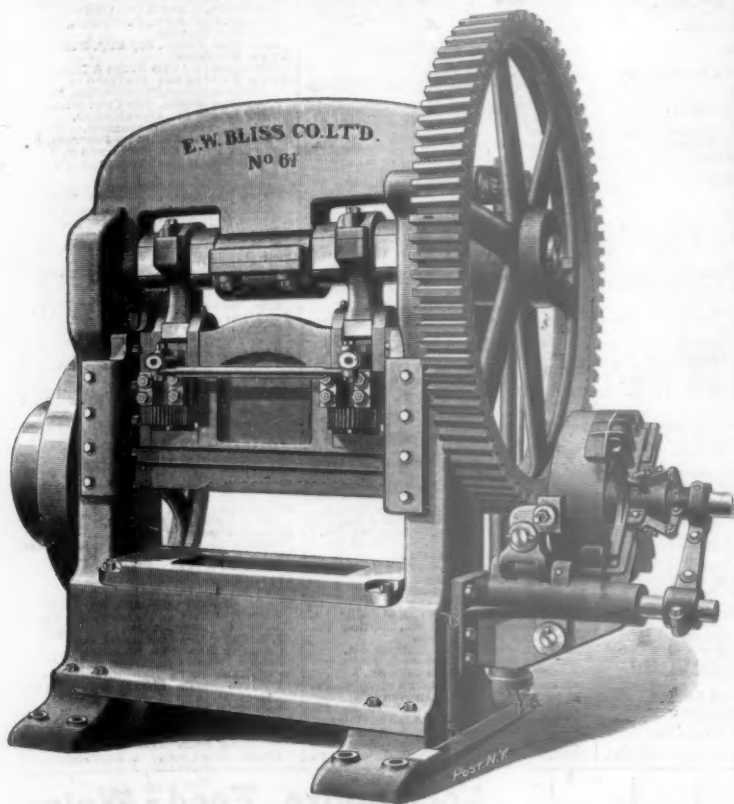
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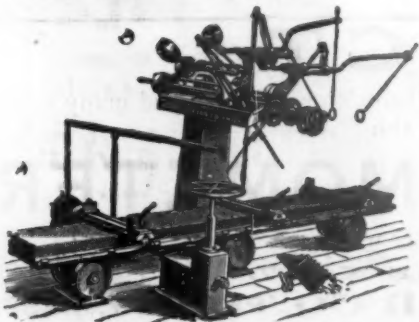
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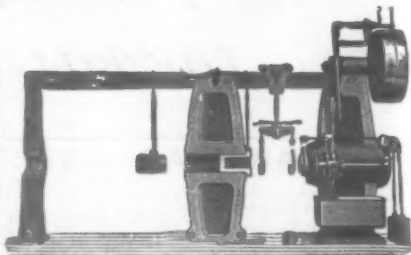
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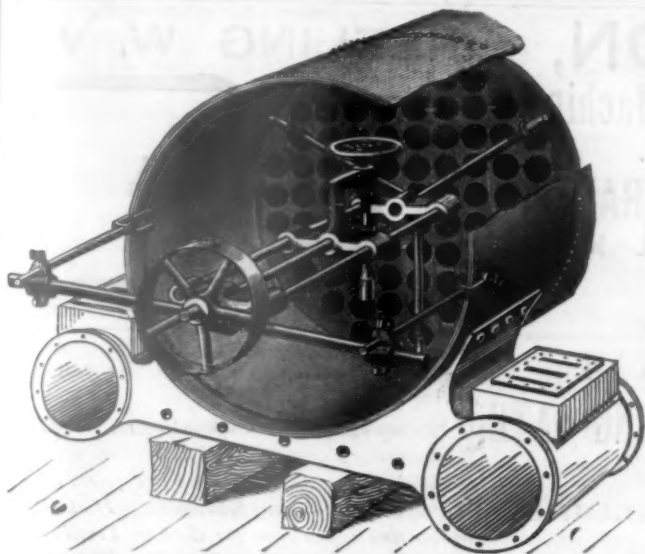
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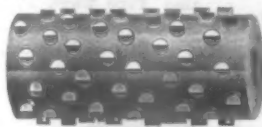
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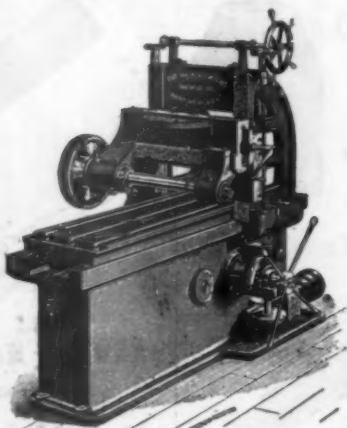
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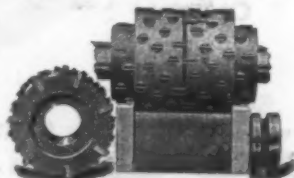
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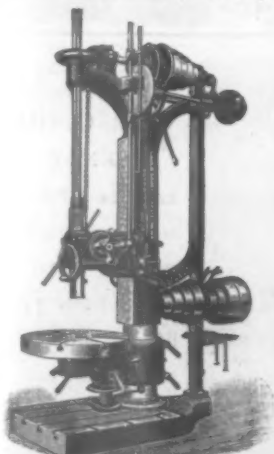
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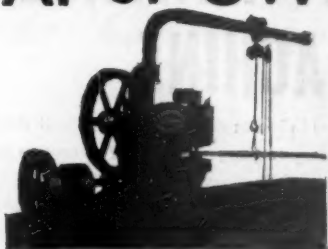
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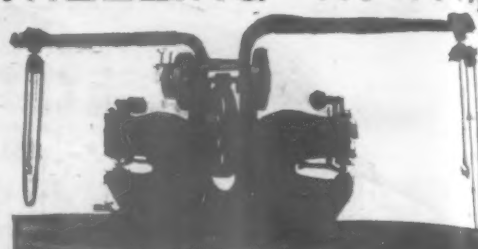
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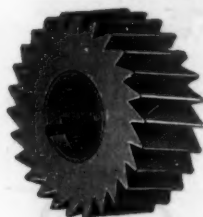
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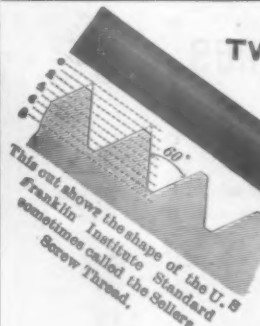


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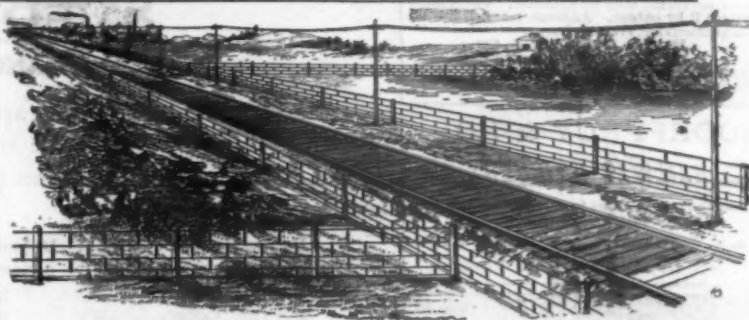
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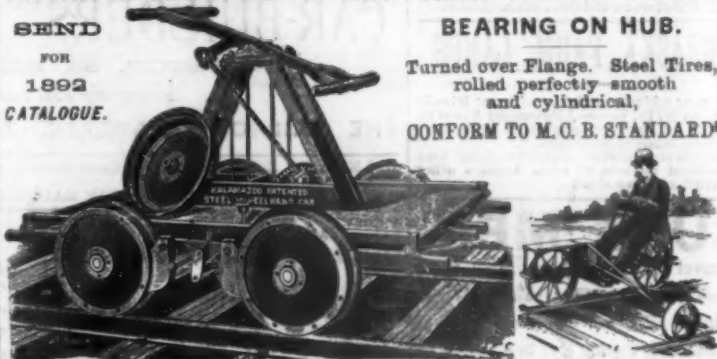
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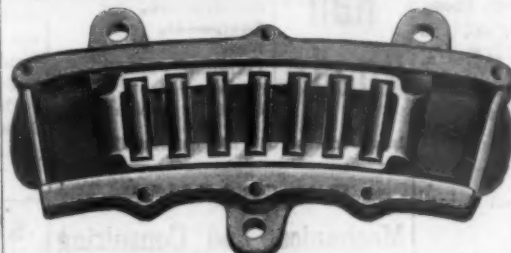
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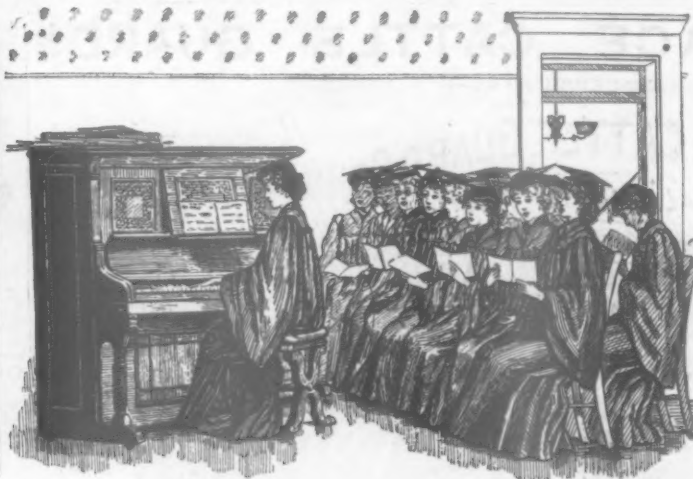
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DANIEL D. WAUGH, Asst. Secy.

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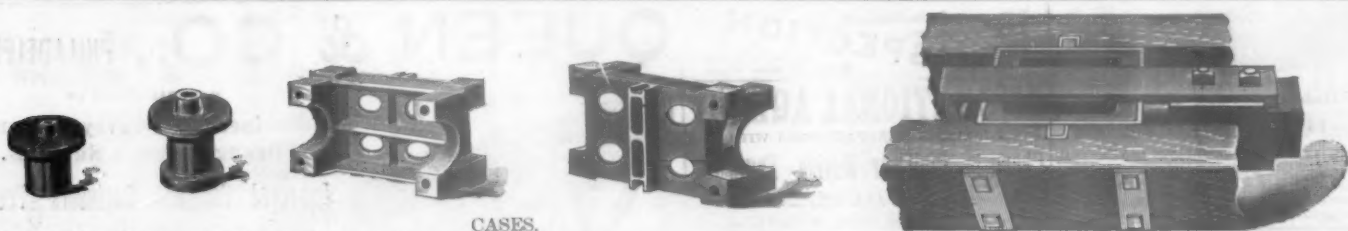
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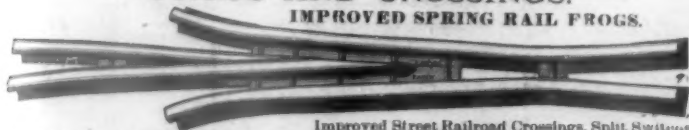
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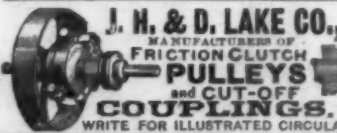
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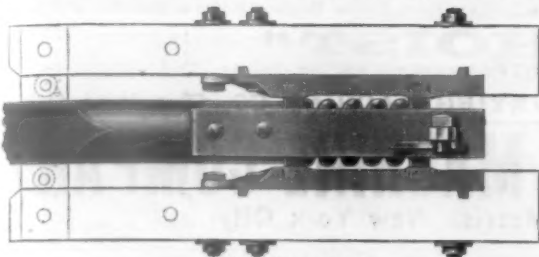
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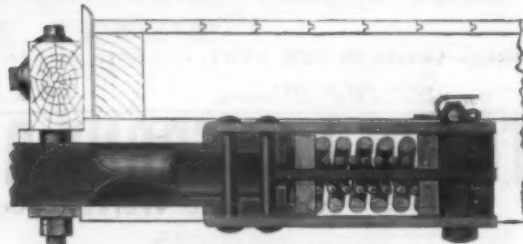
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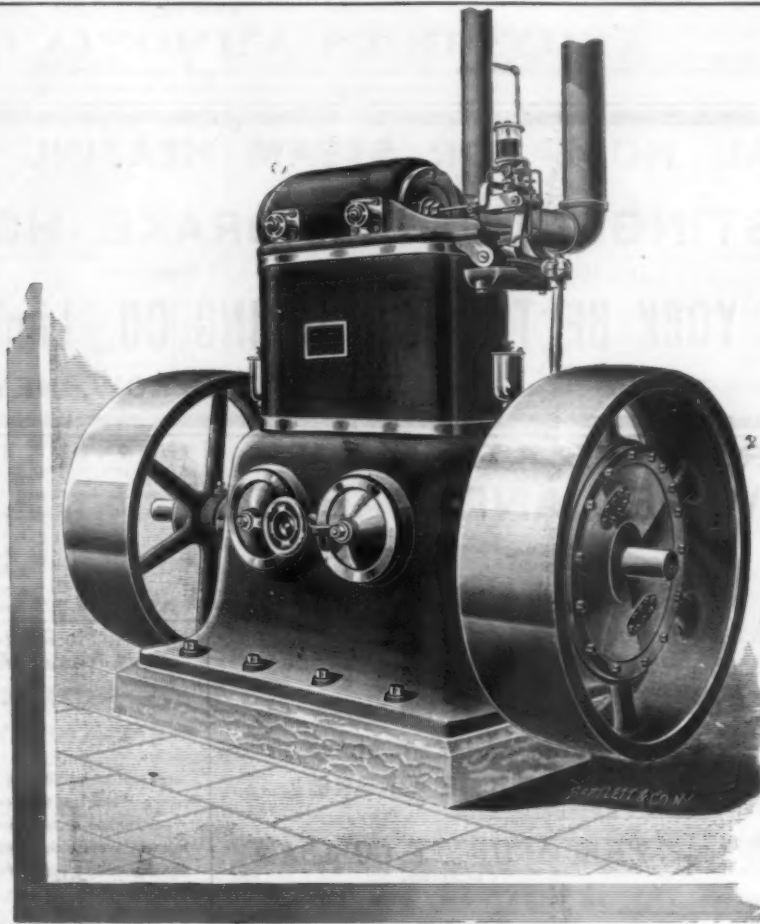
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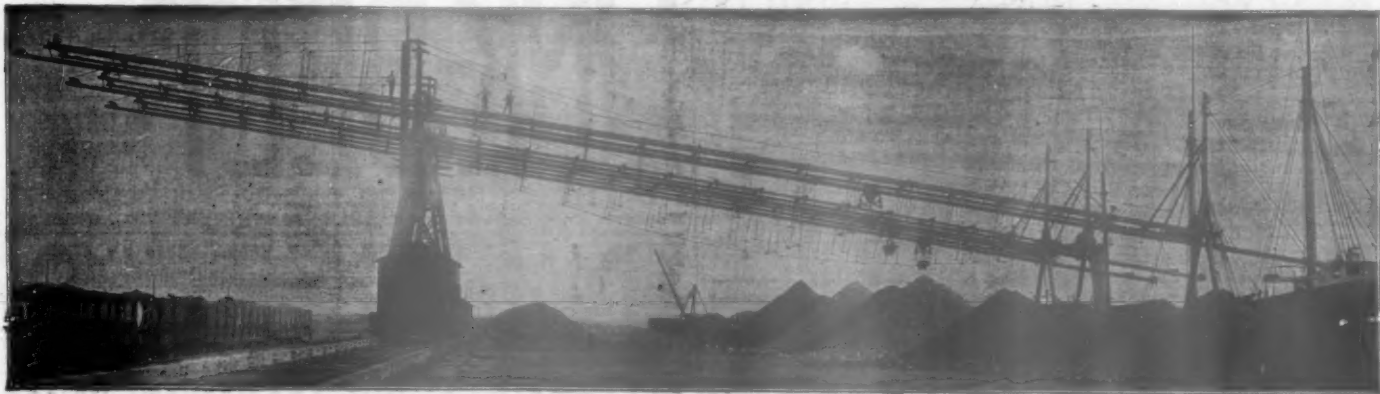
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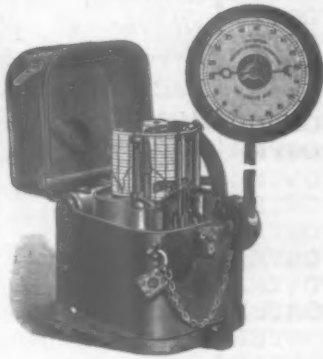
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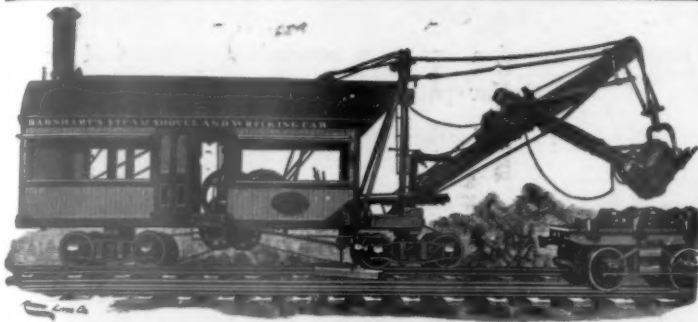
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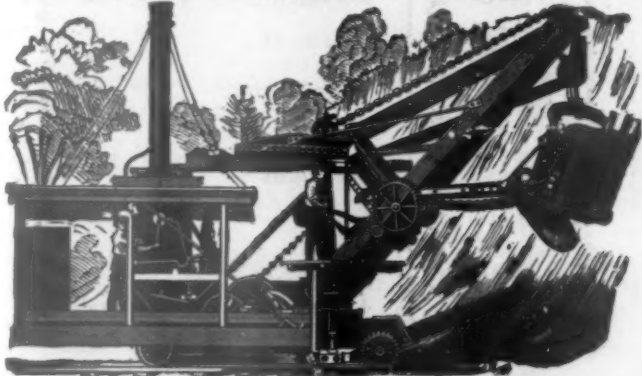
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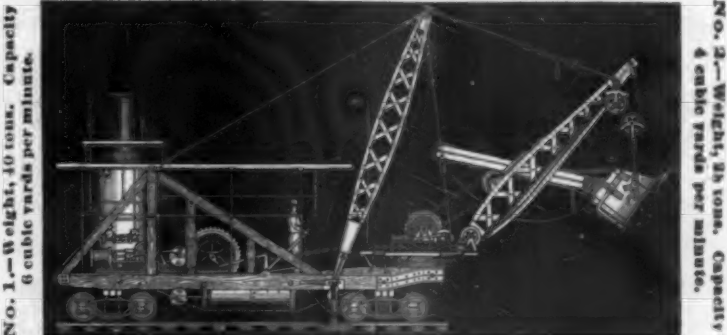
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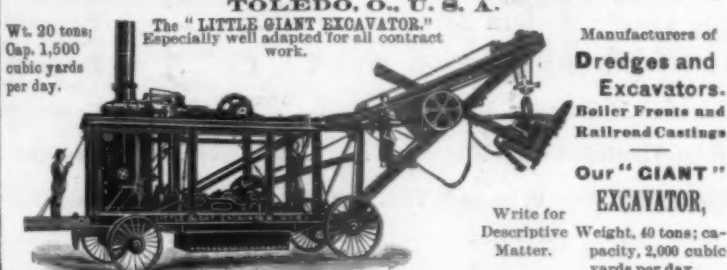


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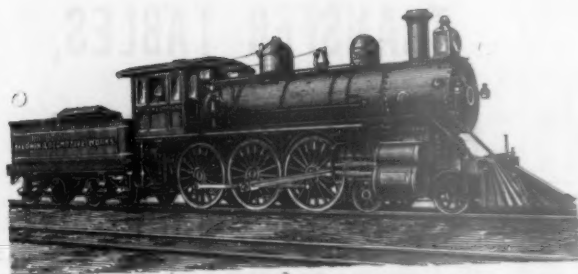
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Western Minas Ry. ".....	1 Passenger 1 Freight	4 Passenger 2 Freight	4 Freight	
Central R. R. of Brazil.....	6 Passenger 11 Freight	2 Passenger 4 Freight		
New York, Lake Erie & Western R. R.....	1 Freight	5 Freight		
Lehigh Valley R. R.....	2 Freight	2 Freight	10 Freight	
Buffalo, Rochester & Pittsburgh Ry.....	2 Freight	4 Freight		
Pennsylvania R. R.....	5 Freight	2 Passenger (Experimental)		
Philadelphia & Reading R. R.....	20 Freight	2 Passenger	4 Passenger	1 Freight
Central R. R. of New Jersey.....	1 Passenger 1 Freight	4 Passenger		
Long Island R. R.....	5 Freight	10 Passenger		
Rio Grande Western Ry.....	1 Passenger	3 Passenger		
Chicago & South Side Rapid Transit R. R.....	20 Passenger	25 Passenger		
Norfolk & Western R. R.....	5 Passenger	10 Passenger		
West Virginia Central Ry.....	1 Freight	1 Freight		
Cincinnati, New Orleans & Tex. Pac. Ry.....	1 Passenger	2 Freight		

In addition to the above, orders aggregating seventy-eight locomotives, from thirty railroads, have been received by the manufacturers. Many of these have resulted from critical observation of the performance of locomotives of this type on other roads.

Experience with compound locomotives which have been in service from one to two years does not indicate an appreciable difference in the cost of repairs, as compared with similar single-expansion locomotives. The results obtained confirm the predictions previously published, that an economy of fuel of from 20 to 35 per cent. in freight service and from 15 to 25 per cent. in passenger service may be guaranteed, varying with the conditions of service. This not only involves less expenditure for coal, but less cost of handling and less labor in firing. The latter are of equal importance whether coal is cheap or dear. Furthermore, the consumption of water is less, the sedimentary deposit in the boiler is less, there is little or no escape of cinders, and less noise attends the operation of compound locomotives.

BURNHAM, WILLIAMS & CO.,
Baldwin Locomotive Works,
PHILADELPHIA, U. S. A.

, 1892

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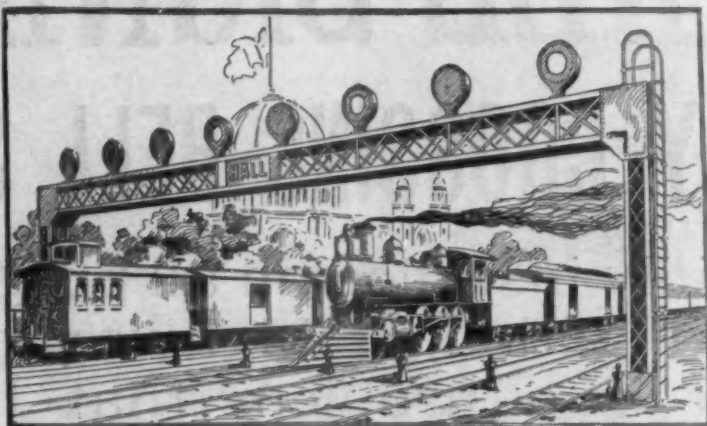
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WORLD'S COLUMBIAN EXPOSITION.



Hall Automatic Electric Block System on the Illinois Central Railroad.

AFTER the most thorough investigation ever made into the subject of block signals THE ILLINOIS CENTRAL RAILROAD COMPANY HAS ADOPTED THE HALL SYSTEM OF AUTOMATIC ELECTRIC SIGNALS for the protection of their entire WORLD'S FAIR TRAFFIC on their eight tracks from CHICAGO to GRAND CROSSING and four tracks from GRAND CROSSING to KENSINGTON.

THE CHICAGO AND NORTHWESTERN RAILWAY COMPANY HAS ADOPTED THE HALL SYSTEM for the block signaling of their Galena, Milwaukee and Wisconsin divisions, 87 miles of double track, 201 block signals, and also providing protection for 188 switches.

THE HALL SIGNAL COMPANY.

WILLIAM P. HALL, President.

W. S. GILMORE, Treasurer.

MELVILLE P. HALL, Secretary.

S. MARSH YOUNG, General Agent.

C. W. BREWSTER, Sales Agent.

HENRY BEZER, Mechanical Signal Engineer.

A. J. WILSON, Sup't Electrical Construction.

W. W. SALMON, Signal Engineer.

General Offices, 50 BROADWAY, NEW YORK.
Western Office, 927 THE ROOKERY, CHICAGO, ILLS.
115 THE AMES BUILDING, BOSTON.

THE HALL SIGNAL CO'S

HIGHWAY CROSSING BELL SIGNALS

Are being rapidly installed on all progressive roads. The proper protection of highway crossings at moderate cost is a problem that has long been before railroad managers for solution.

THE EXPENSE OF FLAGMEN FOR BOTH NIGHT AND DAY SERVICE PLACES SUCH A SYSTEM OF PROTECTION BEYOND THE CONSIDERATION OF MANY ROADS.



THE COST OF MAINTAINING THE HALL CROSSING BELL SIGNALS IS INSIGNIFICANT. THE SERVICES OF ONE MAN ONLY BEING REQUIRED TO KEEP A GREAT NUMBER OF THESE APPLICATIONS IN PERFECT EFFICIENCY.

RAILROAD MANAGERS wishing to make a test of the merits of these signals are requested to notify us, when arrangements can be made with them for a test of their reliability and economy.

THE HALL SIGNAL COMPANY,

50 Broadway, New York.

927 The Rookery, Chicago.

115 The Ames Building, Boston.

OCT. 28 1921

THE NA

The only powerful head
The National Electric
the Queen & Crescent Route



The National Electric
stop a train, even when
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The National Electric
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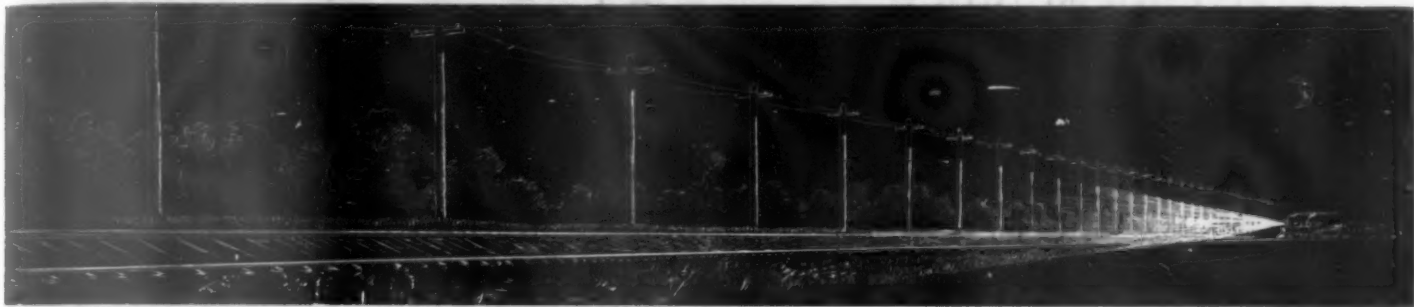
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Chicago

R. B. F. PEIRCE, President and General Manager.

THE NATIONAL ELECTRIC HEADLIGHT COMPANY, INDIANAPOLIS, IND.

The only powerful headlight for locomotives that has stood the test of extensive use. The National Electric Headlight is now in operation on ten roads, among which are: the Vandalia, the Cincinnati, Hamilton & Dayton; the Indianapolis, Decatur & Western, the Queen & Crescent Route, the Monon, and the Chicago & Eastern Illinois. Every engineman who has been behind one of these lights is enthusiastic in its praise.



The National Electric Headlight is advantageously used on passenger and freight trains, on double and single track. It renders any obstacle plainly visible at sufficient distance to stop a train, even when running at the highest rate of speed. An object like a horse or a cow can be seen half a mile, and a car or a larger object can be seen one mile or more. An engine rounding a curve lights up the surrounding country to such an extent that there is little possibility of a collision. In other words, it makes daylight for the engineman for sufficient distance ahead to enable him to prevent collisions and derailments.

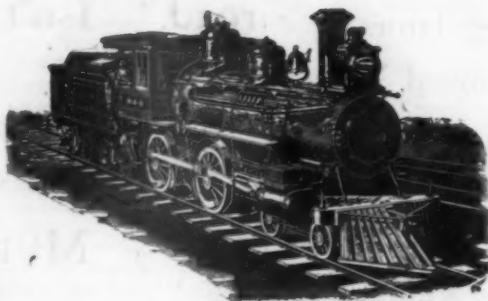
The National Electric Headlight is an arc light of 2,000 candle power, placed in an ordinary case of the usual style, with the ordinary reflector. It is run by a small dynamo placed immediately behind the light, which is supplied with steam by a pipe from the cab. The engineman from his seat can instantly shut off or turn on the steam, and thus extinguish or relight the lamp, as desired. Three years unvarying success in use. Send for detailed testimony, full description and terms. Trial headlights furnished.

THE FIELD FEED-WATER PURIFIER

This device will not successfully handle all waters, but there are none that it will not improve. In a large majority it will demonstrate great economy.

The apparatus can be made at railroad shops at small expense.

A trial is solicited at our expense.



Out showing Purifier Applied to Locomotive.

This water purifier is now in use and on trial on the following railroads:

Wisconsin Central.
Great Northern.
Northern Pacific.
Atchison, Topeka & Santa Fe.
Baltimore & Ohio.

We refer to each of them.

Office: 134 Van Ruren Street.

CHICAGO, ILL.

Factory: 43d St. & Stewart Ave.

CHICAGO SPLICE BAR MILL.

New England Agents,
SHERBURNE & CO.,
No. 53 Oliver St., Boston.

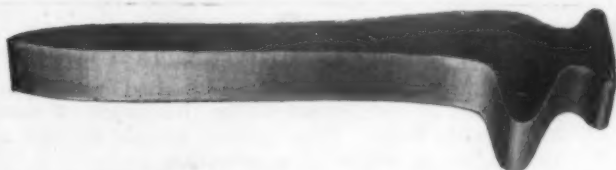
Morris Sellers & Co.,

OFFICE,
216 Phenix Building
CHICAGO.

MANUFACTURERS OF THE

New "GREER" Railroad Track Spike and the Celebrated "SAMSON" Bar.

Fourteen years' unexampled success has demonstrated the fact that under all varieties of Railroad Service they will prevent "low joints," battered rail ends, and in a remarkable degree withstand the test of breakage. More than 10,000,000 Bars in use on 160 different Railroads, equivalent to 14,240 miles of track.



The "Greer" Railroad Track Spike is the latest and best spike offered to the Railroad managements of this country and Great Britain. Indestructible. A holding power of from one to two tons more per spike than any 5 1/2 x 9-16 spike. Automatically sharpened to chisel edge, it cuts; does not tear the wood fiber. Hand packed in kegs—every spike perfect. Particularly adapted for use on Bridges, Trestles, Frogs, Crossings and Switches. SEND FOR TESTS AND PHOTOGRAPHS.

WORTHINGTON STEAM PUMPS

For RAILWAY WATER SUPPLY.

FIRE PUMPS, TANK PUMPS,

BOILER FEED PUMPS,

GAS HOUSE OIL PUMPS,

Water Meters, Oil Meters.

HENRY R. WORTHINGTON,

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GOULDS PUMPS

ARE BETTER.

For Contractors' Use

THE NEW DELUGE

Is better than any other. Built for quick, hard, rough work, and will do lots of it. Hard to choke, and easy to clean. Great capacity, great adaptability, great simplicity, great strength. Adapted for any power.

We think we understand the special needs of Railroad and Boat Builders, Contractors, &c., and The New "Deluge" is made to meet them. Specify it in your work. Get special circular and prices.

THE GOULDS MANUFACTURING CO.,

Manufacturers of Pumps and Hydraulic Machinery,

Factory, Seneca Falls, N. Y., U. S. A. Warehouses, 16 Murray St., New York.

R. D. WOOD & Co. Engineers,
Iron Founders,
Machinists.
PHILADELPHIA, PA.

**CAST IRON PIPES.
HYDRAULIC TRAVELING CRANES.**

Hydraulic Cranes, Presses, etc. Hydraulic Car and Freight Lifts.
HEAVY LOAM AND MACHINERY CASTINGS.

BROWN & SHARPE MFG. CO.,
PROVIDENCE, R. I.

NO. 3 UNIVERSAL GRINDING MACHINE.
for Use in Railroad and Locomotive Shops.



This machine will swing 30 in. between centres
and take 6 ft. in length.
The Head and Wheel Stand can both be set at
any angle.

Reducing Valves,
Air Brake Regulators,
Pump Pressure Regulators,
Balanced Valves

MASON REGULATOR COMPANY,
BOSTON.

CRANES OF ALL TYPES
Particulars
on Application

THE YALE & TOWNE MFG CO., Stamford Conn.
NEW YORK. CHICAGO. PHILADELPHIA. BOSTON.

Facts on Varnish.

NO. 128.—IT DEPENDS ON THE ROAD.

Take for example a railroad with a superb road-bed, the heaviest rails, the finest motive power and rolling stock, a trained and experienced management:

You expect it to deliver its passengers in safety and on time.

It isn't a question of luck; it is one of mastery of the business and resources.

But take another kind of a railroad. Isn't it then a question of luck?

It depends on the point of view. It is just so with varnish makers.

MURPHY VARNISH CO.

FRANKLIN MURPHY, President.

Head Office: Newark, N. J.
Other Offices: Boston, Cleveland, St. Louis and Chicago.
Factories: Newark and Chicago.

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SERVIS TIE PLATES				

Wagner Car Door.

Sets in flush with side of car. Its great merit proven by long years of continuous use on thousands of cars. Sold on royalty basis. Blue prints, sample fittings and full particulars furnished on application.

WAGNER CAR DOOR CO., AMERICAN CAR DOOR CO.
INDIANAPOLIS.
Chicago Office, 323 Phenix Building. ED. J. EAMES, Agent.

JONSON ENGINEERING & FOUNDRY CO.,
Foot East 118th St., New York City,
—BUILD—

Flagg's Patent Railway Crossing Gates, with Jonson's Improvements.
Never Freeze. Never get out of order. Cheapest and best gates in the market.

JONSON'S PATENT COMPOUND BALANCED ENGINES.
MODERATE PRICE. HIGH EFFICIENCY.

—CABLE RAILWAYS.—

We built the Cable Railroad through 125th St. in New York City, complete, and are now building Crossings and Pivotal Elevating Machinery for Third Avenue Cable Railroad.

THE OTIS Elevator

THE STANDARD FOR 36 YEARS.

OTIS BROS. & CO.,
38 Park Row,
New York.

American Flush Car Door.

Sets in flush with side of car. Runs on rollers. Absolutely tight car; utmost ease of motion. We furnish the fittings for this door out of refined malleable iron. Blue prints, sample fittings and full particulars furnished on application.

WAGNER CAR DOOR CO., AMERICAN CAR DOOR CO.
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*We are making a Specialty
of the Preparation, Design and Printing of
Fine Trade Catalogues.
Samples and Estimates upon Application.*

H. B. Prindle & Co.

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TRAUTWINE'S POCKET BOOK.
"The most useful hand-book in the language for the engineering profession."—Engineering and Mining Journal, Aug. 25, 1888.



BELL CORD AND COUPLING.
Solid Braided Cord for Railroad Service.
SAMSON CORDAGE WORKS.
SEND FOR SAMPLES. 115 CONGRESS ST., BOSTON.

EDWARD SMITH & CO., RAILWAY VARNISHES, Times Building, NEW YORK



FRIDAY, OCT. 28.

ILLUSTRATIONS:	PAGE.	PAGE.
Equipment of the Alley Elevated Road, Chicago, (inset).....	797	Personal.....
Compound Locomotive, Chicago & South Side Rapid Transit Railroad.....	798	Elections and Appointments.....
Map of the Norfolk & Western Railroad.....	801	Railroad Construction.....
Pecos River Bridge—Southern Pacific Railroad.....	802	General Railroad News.....
"Giant" Dimension Planer.....	803	Traffic.....
CONTRIBUTIONS:		MISCELLANEOUS:
Ventilated Bridge Cars.....	797	Technical.....
The Railroad Sign Painter's Friends.....	797	The Scrap Heap.....
Finances of the Chicago & South Side.....	797	Ohio Extension of Norfolk & Western Railroad.....
EDITORIALS:		The "New" Panama Canal.....
The Long and Short Haul Controversy.....	806	Annual Meeting of Bridge and Building Superintendents.....
New Hamburg & West Cambridge.....	807	Track Tanks on the Baltimore & Ohio.....
Instructions to the Man Who Does the Work.....	807	Brooklyn Bridge Traffic in the Columbus Week.....
Transportation in Chicago During the Dedication Exercises.....	807	Rapid Transit in London.....
EDITORIAL NOTES.....	806, 809	Passenger Traffic at Chicago on Account of the Dedication Services.....
NEW PUBLICATIONS.....	809	The Canal Conference at Buffalo.....
GENERAL NEWS:		Hardening Circular Cutters.....
Locomotive building.....	813	Convention of the American Street Railway Association.....
Car Building.....	813	Some Disputed Points in Railway Bridge Designing.....
Bridge Building.....	813	Judge Brewer's Decision on the Fourth Section of the Act to Regulate Commerce.....
Meetings and Announcements.....	813	

Contributions.

Ventilated Bridge Cars.

The following is part of a letter recently published in the New York Sun:

"Now, during three minutes of the travel over the bridge all the fresh air contained in the cars is consumed, and during the other three minutes the passengers inhale air unfit for healthy respiration; the respiratory movements continue, but the normal interchange of gases in the lungs is suspended, and the passengers are thus subjected to a state of suspended animation. The bridge cars must be reconstructed. Their ventilation must be adapted to the real number of passengers that are packed in them, suggesting the idea of a sardine box. Is it necessary that on a suspension bridge you must undergo suspended animation?"

"P. J. POPOFF, M. D."

Concerning this we have received the following letter:

BROOKLYN, Oct. 22, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

P. J. Pop-off, M. D., who writes to the Sun on ventilation, is too effervescent and should be tied down. His letter calls to mind the man who, riding in a street car with a tidy bit of "Limburger kase" in his pocket, complained that a fellow passenger was uncleanly.

It is with us often "as we think we are." Ventilating cranks frequently are mistaken. Not far from this town, some time since, to introduce an abundance of fresh air into a public building which previously had seemed greatly to lack it, a ventilating apparatus, at considerable expense, was put in and operated for months to the satisfaction of the inmates, until, upon examination by an expert, it was found that in consequence of a mistake in erection the devices employed were removing no air whatever from the building.

Each car on the Bridge railroad is amply provided with ventilators and any one familiar with the subject can for himself see that this is so. The newer cars are equipped with one of the best systems for the purpose now in use. Moreover, every six minutes, the time of passenger transit by the opening of wide doorways at the front and rear of the cars, and also, when the trains are crowded, of equally capacious spaces at each side, aided by the movement of the passengers leaving and entering, there is a complete interchange of air.

CIVIL ENGINEER.

The Railroad Sign Painter's Friends.

Oct. 22, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Let me further call your attention and Mr. Brophy's to the fact that King James' Bible also uses the words "not" and "nor" in conjunction, as did the railroad sign painter complained of by Mr. Brophy. See Exodus xx., 5: "Thou shalt not bow down thyself to them, nor serve them;" Exodus xx., 17: "Thou shalt not covet thy neighbour's wife, nor his man servant, nor his maid servant, nor his ox, nor his ass, nor anything that is thy neighbour's."

I think Mr. Brophy may claim, and not without reason, that King James and his learned translators are hardly final authority for railroad sign painters of today. That artist, for instance, could hardly be expected to make a sign read: "We pray you, tarry awhile from the way, until the locomotive and its following be passed by;" but these instances from the old style at least make me cautious about condemning "Not-nor" as absolutely ungrammatical.

And as to modern English, we find in Rules of Practice, U. S. Patent Office, Revised Edition, page 9, Ar-

ticle 24: "A patent may be obtained by any person who has discovered any new or useful art—not known nor used—in this country and not patented nor described—in this or any foreign country—and not in public use nor on sale," etc.

I fear the weight of authority is on the side of the railroad sign painter and against Mr. Brophy and

NOTNOR.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The sentence quoted by Notnor from the English Prayer Book must have been written before 1602, and as the American Prayer Book of 1789 renders it, "and therefore is not by any to be entered into unadvisedly or lightly," I think Mr. Brophy is right and the sign painter is wrong.

A. MODERN.

[Probably this discussion had better be dropped now, for we are not keeping that kind of a school.—EDIT. OF RAILROAD GAZETTE.]

Finances of the Chicago & South Side.

CHICAGO, Oct. 25, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Some comment has been made by the Chicago press on a recent notice convening a meeting of the stockholders of the Chicago & South Side Rapid Transit Railroad Co. to pass upon a proposed issue of \$3,000,000 of first mortgage bonds to cover the construction of the second division of the road. The tone of these articles shows a misconception concerning the original issue of bonds that is easily corrected by referring to the terms of the original mortgage under which the first section has been built. The mortgage of the first section was made to cover an issue of \$7,500,000 of five per cent. bonds, which have been issued only on engineer's estimates of work done and material furnished by the company which undertook the construction of the road. Both mortgage and bonds relate wholly and solely to the first section of the railroad, extending from Van Buren to Sixty-seventh street, a distance of about eight miles, in the city of Chicago. Under the power conferred in the mortgage upon the trustee to permit such necessary changes to be made in the line of the first section, as might be found advisable and advantageous, that part of the originally projected line running through the alley between Van Buren and Congress streets has been postponed, or abandoned, and the line actually commences at Congress street. For similar reasons the construction of that part of the section extending from Sixty-third to Sixty-seventh street has been held in abeyance, the country in that neighborhood being at the present time practically uninhabited; but enough bonds of the original issue have been reserved to complete the road to Sixty-seventh street, whenever that may become desirable. The remainder of the original issue of \$7,500,000 of bonds has been devoted exclusively to the first section, which is substantially completed to Sixty-third street, and fully equipped for operation.

The second division includes not only that part of the road running from the south line between Prairie and Calumet avenues to Jackson Park, but also an extension from the junction of Sixty-third street with Prairie and Calumet avenues westward through Englewood, and it is to cover the construction of this second division that the additional issue of \$3,000,000 of first mortgage bonds, upon the second division only, has been called for. In anticipation of such an issue a large amount of work has been done upon that part of the second division, in order that the road may be finished to Jackson Park in time for the opening of the World's Columbian Exposition and may reap the benefit of that traffic.

Most of the criticism above referred to has been directed to the fact that this second section is to be bonded for as much per mile as was the first section. Such criticisms are wholly groundless and are made in ignorance of the real facts of the case. While the first division of the road is a double track line, that part of the second section lying between Jackson Park and the junction with the first division, between Prairie and Calumet avenues, is to be a three-track structure. The cost of proper terminals to handle the traffic of the World's Fair is also large, but necessary to handle that traffic at all, while large expenditures have to be made for bridges, etc., which were avoided in the first division. For example: the bridge over the Illinois Central tracks is to be a steel structure of 226 ft. span and over 500 ft. of equally expensive structures must be thrown over the tracks of the surface railroads crossing Sixty-third street east of Englewood. While the large expenditures connected with the acquisition of right of way on the first division are largely avoided on the second, other expenditures necessitated by engineering problems, etc., on the second division will probably bring the cost of construction quite up to that of the first division.

The second division of road referred to will not only secure a large percentage of the World's Fair business and, subsequently, a continuous large traffic from the parking systems of the South Side, but will control the bulk of the daily city traffic to and from Englewood and the populous districts of the southwestern section; such traffic being in fact a necessity in order to make the investments in the securities of the first division continuous paying investments from the time the road is turned over by the Construction Co. to its owners.

X.

The Equipment of the "Alley" Elevated Road, Chicago.

[WITH AN INSET.]

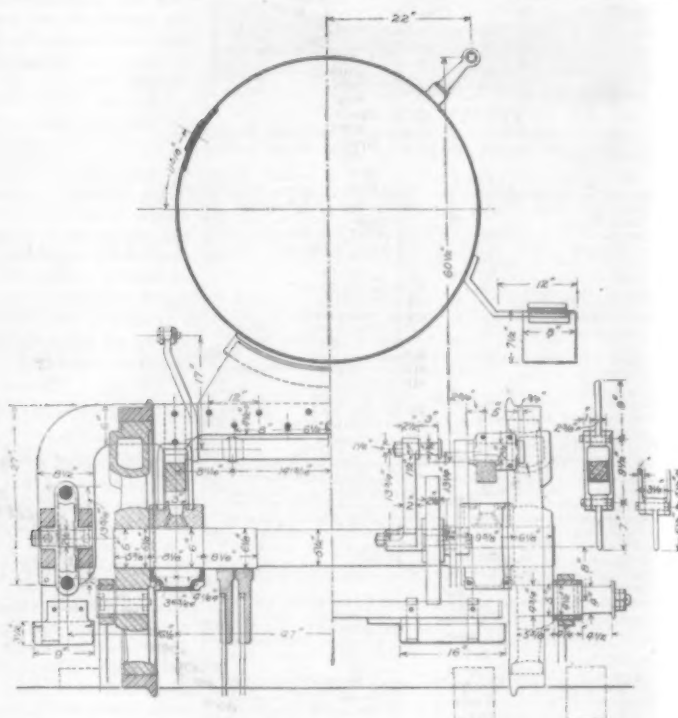
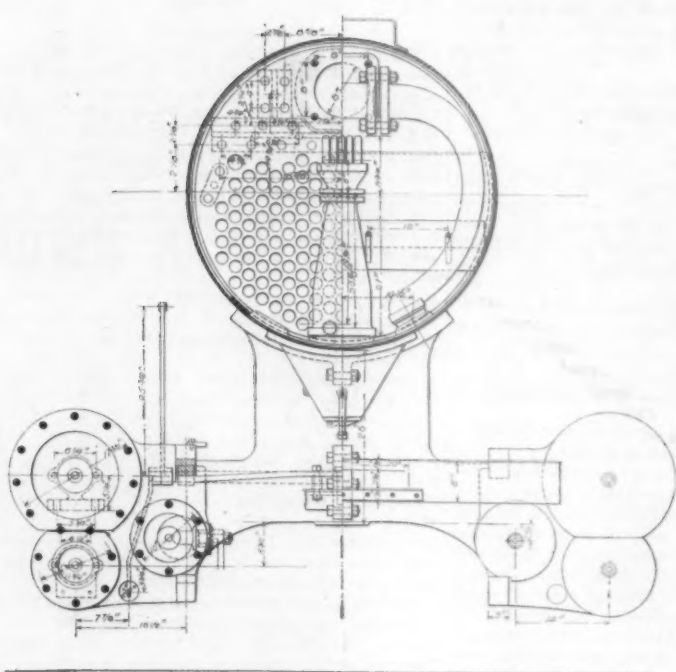
The development of the Alley elevated road in Chicago, owned and operated by the Chicago & South Side Rapid Transit Railroad Company and built by the Rapid Transit & Bridge Construction Company, is full of interesting detail. The original scheme for this road was projected by Colonel Alfred F. Wallcott, of New York city, now President of the Metropolitan & West Side Elevated of Chicago. The late Col. Calvin F. Goddard was formerly President of the "Alley road," and took an active part in its construction until his death in the early part of this year. Colonel Goddard supervised the building of the road as far as Thirty-ninth street, but the extension and the completion of the line, and the method of its operation, has been supervised and arranged by his successor, Dr. W. T. Barnard, who for many years was closely connected with the management of the Baltimore & Ohio road. Mr. R. I. Sloan, for some years chief engineer of the Manhattan Elevated road, has been chief engineer of this road since the resignation of Mr. G. B. Cornell. The line is now completed as far as Sixty-third street, and will be finished to the World's Fair grounds before the first of next year. There are in contemplation several branches and extensions, which may be started before the line to the fair grounds is finished.

The whole scheme of running this road and the plan of dealing with the employees are novel in many respects, and so far have proved very efficient. The equipment, method of operation, and the arrangement of stations, etc., are different from other elevated roads. We have described the stations and structure and have had some accounts of this road before in the *Railroad Gazette*. See Feb. 14, March 21, April 4, 1890, and April 17, July 24, Nov. 13, Dec. 11, 1891; also March 18, April 15, June 3, June 10, June 17, 1892.

Stations.—The stations are under the structure [with the entrance on the level of the street, and are fitted up in a very complete way, having all modern conveniences. They are built of brick with tile roofs, and are quite ornamental. The platforms are reached by staircases and arranged on each side of the track, as in New York. Each platform has a platform-man who looks after the safety of the passengers and answers inquiries. There is a porter in each station to help passengers. There are also one ticket seller and one ticket collector; all of whom are relieved at regular intervals, thus making in all, for the average station, four platform men, one porter, three ticket sellers, and two ticket collectors. The platform men, the conductors and guards on trains, and all officers of the company are invested with police authority, and can arrest disorderly persons.

Equipment.—The more special novelties in equipment are the heavy compound engines, of special design, the Westinghouse air brake, and the means for preventing water and oil from dripping into the streets. There are no drip pans under this structure as in New York, but instead every precaution is taken to prevent water from dripping into the streets by the use of drip pans and tanks under cars and locomotives. The cars, which are equipped with the Gold heating system, have a special arrangement for collecting condensation in tanks at their ends from which it is drained at the terminal stations. The locomotives have specially arranged drip pans which collect all the water and oil from the engine. The ash pans are made tight and water is carried in their bottoms to quench sparks. Water is also carried into the smokebox to quench cinders. So little condensation from the steam heating system reaches the couplings between cars that leakage at these points will consist mostly of steam. If the automatic couplings leak, a solid coupling with a screwed joint will be substituted. This will cause no serious inconvenience as the trains are seldom broken; the cars remaining together almost constantly, and the time required to make a solid joint will not interfere with the movement of trains.

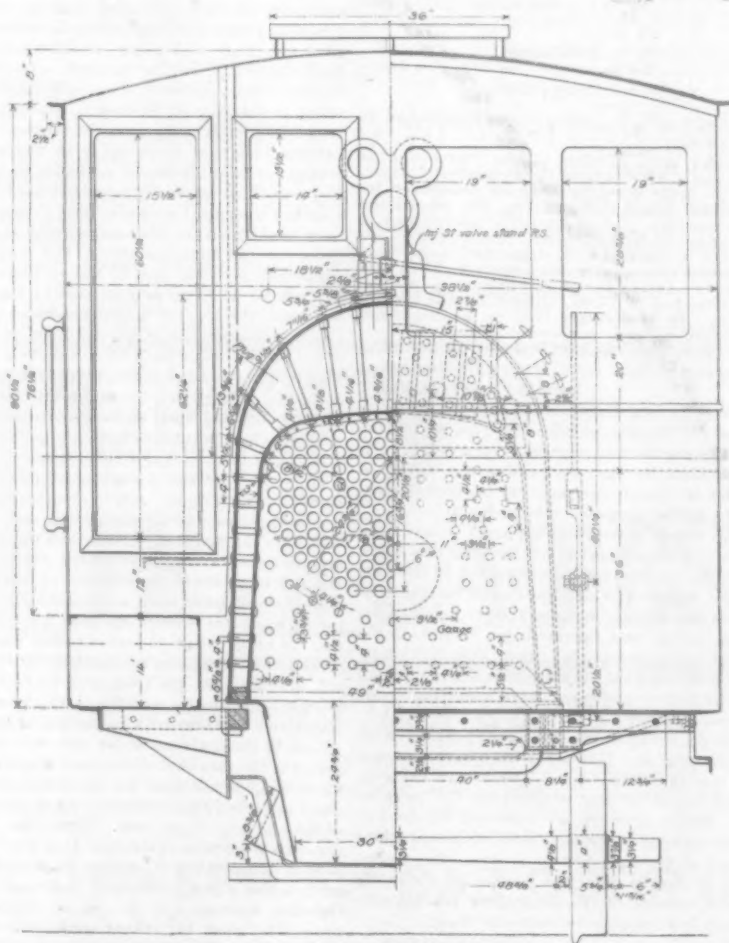
Cars.—The cars seat 58 passengers, and are finished in light colored mahogany with carved ornamentation. The seats are of rattan, arranged on the sides at the ends, and crosswise at the centres. The window and door glass is plain at the bottom with a slight ornament at the top. The end doors are double and arranged to open together; that is, whenever one door is opened the other opens automatically. The platforms are wider than those of the cars in New York, which naturally facilitates the movement of passengers. Two passengers can pass in and out of the cars abreast without the least inconvenience. The cars have the Vaulclain, wrought-iron truck wheels, and are strong and complete in all their appointments. The couplers between cars are made to couple almost automatically, and are especially designed for eight-car trains. These drawbars couple together with taper keys, which take up the slack, instead of the ordinary round, straight pins, and there is no free slack between cars. This makes the cars ride with great steadiness and there is no disagreeable motion when the brakes are applied, as is the



case when the round links and pins become worn. All of the safety gates and platform gates have been especially constructed for the safety of the passengers and for durability, the bearings having hardened bushings. They are so arranged that it is practically impossible for a passenger to be injured, but as an additional safeguard the station platforms have been provided with railings having openings opposite the gates of the cars, with an allowance of only 14 inches each way, so that it is practically impossible for a passenger to be injured either by falling from the platforms of the stations or from the platforms of the cars. During the severe rush on Labor Day, recently, though the platforms of the stations were full of people, and the six-car trains were so full that passengers had to be refused, not a single accident happened, and it could not be seen that anyone was in the slightest danger. Of the millions of people carried since the road opened, not one has been injured in the slightest degree.

Speed and Work.—The speed on this road is considerably higher than on any other elevated road, it being an average of 15 miles an hour over the line, with stations averaging about $2\frac{1}{2}$ to the mile. This high average speed increases materially the work to be done, as the power of an engine hauling suburban trains is principally expended in raising the train and locomotive from a standstill to the maximum speed between stations. The amount of work required to do this varies as the square of the maximum speed, and the maximum speed varies approximately as the average speed for equal distances between stations; therefore, it is, by a careful estimate, found that an average speed of fifteen miles an hour (which is an increase of about $3\frac{1}{2}$ miles above that in New York City) requires the expenditure of about 70 per cent. more power for the same weight of train. The trains in Chicago consist of five cars, generally, and occasionally six; the train weight varying from 128 tons to 148 tons. All station platforms are being lengthened and otherwise provision is being made to meet the expected heavy traffic of the World's Fair, during which period trains of eight cars will be run, express. It was not so much with a view to this class of service as for the difficult local train service that the equipment was designed extra heavy. It is the local train service calling for frequent stops that requires the heaviest locomotives. As we have said before the work of locomotives on elevated roads is almost entirely that of accelerating trains; that is, a grade of two per cent. offers only about one-third the resistance that is offered by the inertia of the train in its resistance to the increase of speed, so that the 20 tons on the drivers of the engines on the Chicago elevated road is for the purpose of accelerating the trains. Less would answer for express purpose, as it would only require about one-half of this weight to propel an eight-car train after it is in motion.

Brakes.—The Westinghouse, automatic, quick-acting air brakes have been adopted on this road for several important reasons, and after very considerable discussion. In fact, a period of three months was occupied in discussing the question pro and con, and listening to arguments on both sides. The argument against the Westinghouse brake was that it would not release quickly, would cost more for repairs, and accurate stops could not be made at stations. The argument in favor of it was that it was wholly unsafe to run a five-car train at 30 miles an hour or a longer train at 25 miles an hour on an elevated structure without a quick-acting and automatic brake. Those



COMPOUND LOCOMOTIVE FOR THE CHICAGO & SOUTH SIDE RAPID TRANSIT RAILROAD.

who understand braking will realize that any direct acting, non-automatic brake requires time for the application of the brake force, and there is no certainty that the apparatus is in condition to be used until it has been applied. The engineer has no knowledge of the efficiency of the braking apparatus until he uses it, when it is too late to remedy a defect. For instance, in case of a non-automatic brake, if a train is approaching close to an open switch or other danger point, it cannot be stopped with certainty for two reasons: First, there is no certainty that the brake is operative; and, second, there is not time enough to apply the brakes fully. It was therefore decided that an emergency brake was necessary for the safety of the trains that were to be run on the Chicago roads.

The automatic feature is used for the good and sufficient reasons, that almost everyone knows, and for which it is used on almost every surface road in this country and on the majority of important roads in foreign countries. Railroad men, as a rule, have long since ceased to inquire into or discuss the value of an automatic brake. Everyone knows that by it alone can safety be assured to trains which are running at

considerable speed, particularly where the car platforms are liable to be crowded with passengers or there is any considerable grade. For instance, with a train running at 30 miles an hour and the platforms crowded with passengers; if the train breaks in two, the passengers on the platform are in danger as the engineer would in such case shut off steam and the rear of the train would most surely rush into the front, and cause serious damage. In coming out of the World's Fair grounds the trains will have to start on a grade and immediately ascend a two per cent. incline over the Illinois Central's elevated tracks. If an eight-car train, or a five-car train, should break in two on this grade without an automatic brake, the only means of stopping it would be by the brake wheels provided on the cars. The platforms in such cases would probably be crowded, the brakeman could not reach the brake wheel, or handle it properly, and it is a question whether he would have enough presence of mind to apply the brakes, anyway. If the hand brakes were not applied immediately, with full force, the train would reach the end of the station before it could be

stopped and the cars would pile over the structure to the ground, a distance of about 20 ft. There are still other reasons why the automatic emergency brake was adopted. This brake has been in service now about four months, and the repairs so far have been nil. The stops are made with accuracy, there being only 14 inches leeway allowed between the openings in the railings on all station platforms, which makes the service much more difficult than that in New York where there is 7 feet leeway and where there are railings on but few platforms. The percentage of bad stops is very small, and the record shows that some of the engineers on the road have not made a bad stop in months. A stop is considered to be bad when passengers cannot enter both gates without being crowded between the car and railing.

To insure additional safety to passengers, check chains made of iron $1\frac{1}{2}$ inches in diameter are provided on all cars, with rubber cushions under the eye bolts. Thus a break-in-two of these trains is practically impossible. Either chain is sufficient to hold the car in case the break-in-two occurred on a curve, where only one chain would pull taut.

Lighting.—The Putzsch gas system has been a decided success. The mats in the cars are not discolored by oil from lamps, and there are no smoky chimneys or bad lights complained of. The patrons of the road are enthusiastic about the gas light, the cost of which is a nominal matter. It may be more than kerosene, but the difference in dollars and cents is too small to be any objection. There are three, four-burner lamps in each car, the light from which is sufficient to enable a person to read fine newspaper print in any part of the car.

Locomotives.—The locomotives of the South Side Rapid Transit have been the object of special interest to railroad men because of the novelty of their design and because the compound system is here used on an elevated structure for the first time, except on two trial locomotives on the Brooklyn Elevated road. The type of the compound cylinders is the Vauclain. The engines were built by the Baldwin Locomotive Works, according to designs furnished by Mr. D. L. Barnes, Consulting Engineer of the road. We have heretofore given some of the general dimensions of the engines, (see *Railroad Gazette*, April 15, 1892, and now give a side elevation and sections, together with a perspective taken from a photograph. The following are extracts from specifications of the engines:

Cylinders, Vauclain, four-cylinder type... 9 in. and 15 in. \times 16 in.
Driving wheels... 42 in. diam. outside of tire.
Gauge... 4 ft. 8 $\frac{1}{2}$ in.
Boiler, radial stay wagon top
16 in. diam. at front end, 116 $\frac{1}{2}$ in. long.
Firebox... 63 $\frac{1}{2}$ in. \times 43 $\frac{1}{4}$ in.
Flues, 167... 1 $\frac{1}{4}$ in. diam., 76 in. long.
Grates suitable for anthracite, coke and pea coal.
Truck wheels... 26 in. outside diameter.
Tank capacity... 750 gallons.
Driving wheel base... 5 ft.
Truck wheel base... 4 ft. 8 in.
Total wheel base... 16 ft. 4 in.
Weight on drivers in working order... 40,000 lbs.
Weight on truck in working order... 18,000 lbs.
Total weight in working order... 58,000 lbs.
Grate area... 19 sq. ft.
Area, flue heating surface... 485 sq. ft.
Area, firebox heating surface... 70 sq. ft.
Total heating surface... 555 sq. ft.

The shell seams are butt joined with lap welds and joints are calked inside and out. The boilers are built to be safe with 200 pounds working pressure, but are run at 150 pounds. The dome is put on the boiler by an angle iron ring riveted both to the dome and the shell. Neither the shell nor the dome is flanged. The furnace doors are arranged to slide laterally and can be opened quickly. The ash pans are bolted to a separate flange which is secured to the firebox ring in such a way as to prevent ashes from getting to the driving boxes or dropping to the street below.

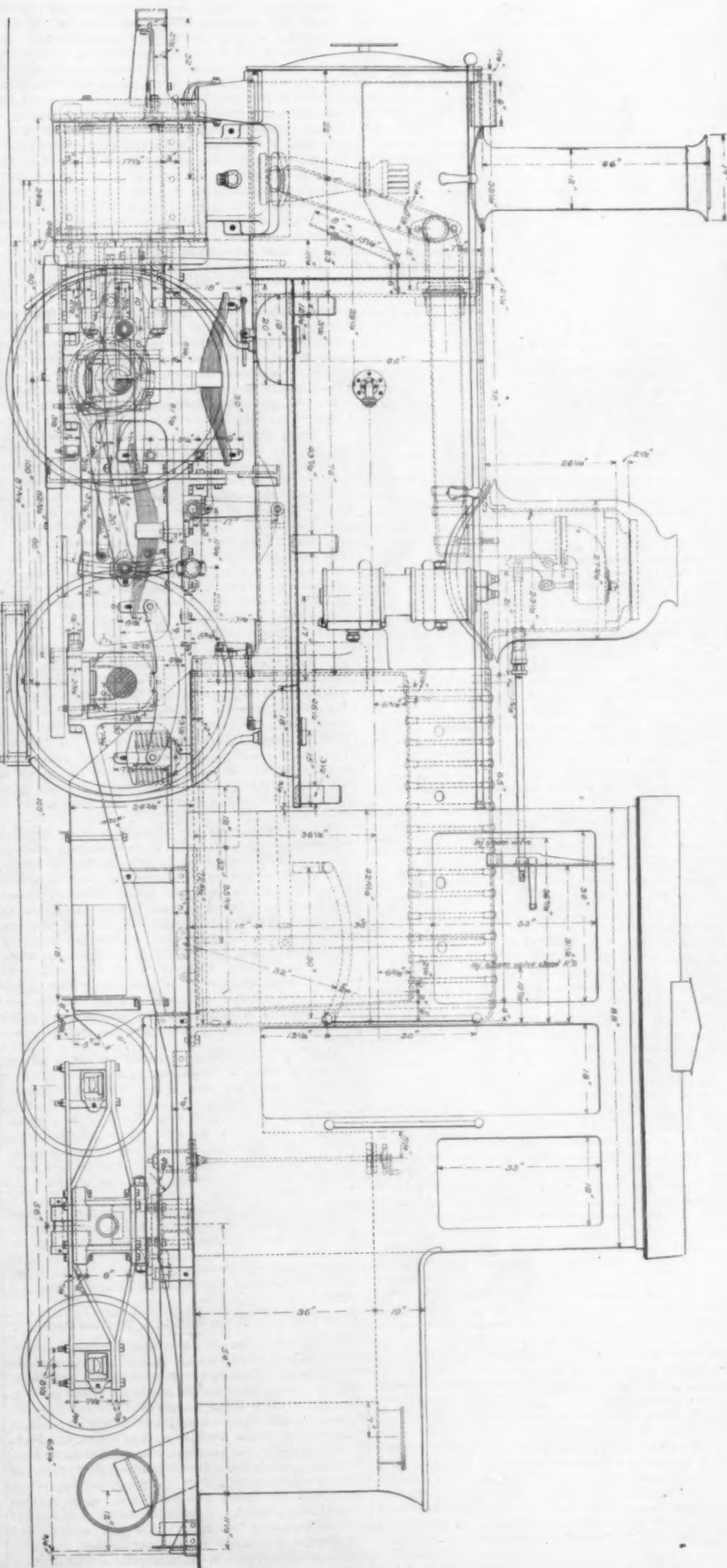
The throttle rods, as well as the air pump piston rods, valve stems, and main piston rods, all have metallic packing. Several kinds of packing are used, including the United States, the Jerome, the Sullivan, the Columbian, the Illinois Central, and the Wabash types.

The steam pipes in the smokebox are bolted to the cylinder saddles with bolts having heads 3 in. long so that they can be removed without being drilled out, as is frequently the case when those having small heads are rusted in.

The gauge cocks have babbitted stems. The blow-off cocks are of the slide valve pattern to prevent leakage. Cleaning plugs are placed above the crown sheets on the sides and ends to enable all parts of the crown sheet to be scraped in order to remove scale. The injector checks are the kind known as the "inside" type; that is, in case there is a rear collision and the check pipes are knocked off, steam and water cannot blow out and scald passengers. There is also an intermediate check valve provided between the injector and the checks to be used in case the inside checks leak. The ash pans are made of 3-16 in. tank steel and are calked water tight. The smokebox netting is $3\frac{1}{2} \times 3\frac{1}{2}$ in. mesh No. 12 steel wire, arranged horizontally without a vertical section and a spark-tight joint is made between the horizontal netting and the smokebox door.

The boilers are covered with asbestos plaster $1\frac{1}{4}$ in. thick. A cinder pocket is provided in front of the smokebox to catch the cinders, and into this the cylinder cocks are drained to quench sparks. No mufflers are used on these engines as, owing to the compound system, the noise of the exhaust is exceedingly small. This removes one of the objections to using steam on elevated roads, as the back pressure due to mufflers is sometimes very great, and

COMPOUND LOCOMOTIVE FOR THE CHICAGO & SOUTH SIDE RAPID TRANSIT RAILROAD.



is especially so when the mufflers get clogged, as all mufflers do.

The blower in the smokebox consists of a ring drilled with small holes, the ring surrounding the nozzle. The cylinders of these engines are cast together with one-half saddle and there is but one joint between them. This joint is at the centre. The cylinders are interchangeable from right to left. The valves are of the piston type, made of cast iron with cast iron packing rings. The cylinder and steam chest casings are made of pressed steel one-eighth of an inch thick. The cylinder oilers are of the Nathan triple sight feed type.

The pistons are of wrought iron turned all over on the outside faces and of the double plate type. They are exceedingly light and require but little counterbalance. The outside of the pistons is covered with babbitt 1-16 in. thick where they bear against the cylinders. The piston rods are of forged steel, ground true and smooth on centres. The guides are of hammered iron, case hardened. The crossheads are of cast steel with wings cored out and of the least possible weight. The bearings of the cross-heads, instead of having brass liners, which increase the weight, are babbitted 1/4-in. thick. The main and parallel rods are made of steel, the parallel rods having bushed bearings.

The valve motion is made unusually large, having about the same wearing surfaces as large engines used on surface roads. All bearings are bushed with hardened bushings. All bearing pins are hardened and ground.

The main frames are made of hammered wrought iron, made from scrap that has been rattled before piling and is free from steel pieces. The frame extends in one piece from end to end of the engines, and in this way differs from other elevated engines. The joints of engine frames are always a source of trouble, and it is to remove this difficulty that these frames have been made in one piece. The dimensions of the frames are unusually large, and by reason of the care taken in manufacture and the liberal use of material the makers of the engines have been willing to guarantee them against breakage for five years.

The driving wheels are of wrought iron made by the Standard Steel Works, under the Vauchain patents, the counterbalance being forged in the wheels. The driving axles are of steel with 6x8 in. journals. The crank pins are of steel and have large dimensions, as shown by the drawings. The driving boxes are of phosphor-bronze, and have the inside flange 1/2-in. thicker than the outside so they can be reversed to take up wear. The driving springs and equalizing arrangements have been arranged to make the engines ride easily and there are no dead ends to the equalizers, all points being carried on springs. The beams have hardened steel bearings and the springs are guaranteed for five years.

The truck is of a swing-motion, swiveling type, adapted for curves of 90-ft. radius, the swing links have double bearings at the top to give the trucks stability when in the central position; that is, the trucks offer resistance to movement laterally when at the centre. The benefit of this has been even greater than was expected, as there is less flange wear than usual for this class of engine. The swing centre is formed of plate springs with the ends curled over to receive the pins through the swinging links.

The truck wheels are of wrought iron with steel tires held by retaining rings. The truck axles are of steel with journals 3 3/4 x 6 in., the journal brasses being of phosphor-bronze. The truck springs are guaranteed for five years.

The water tanks are of sheet steel with the sides in one piece with the sides of the cab. The feed water reservoirs in the bottom of the tank are of a special design made by the Baldwin Locomotive Works, and have reversible strainers which permit them to be cleaned quickly. The cabs are of sheet steel and sheathed at the top with wood and there is a wooden floor over the tanks. It will be noticed that the tanks run under the cab and form the cab floor, except at the centre portion, which is formed by a flat sheet running under the coal space. The cab windows are arranged to slide and drop so as to give good ventilation. The window in the door also drops. All the tool boxes are of sheet steel. The running boards are of steel with an angle iron finish, the sand boxes being placed under the running boards. Considerable trouble was had with the injectors, and it is now decided to use one Monitor and one Sellers in each engine, the overflow from the injectors being returned from the tank. The driver brakes are of the Westinghouse "spread" type and are connected up with the train brake and applied automatically. The head lights are placed on the front of the smokebox at the front and on the back of the tank. The drip pans are made of sheet steel arranged to be drained through two valves, by pulling one handle in the cab on the fireman's side. No drippings are allowed to fall to the street. All oil and water are collected in pans which are emptied at the terminal. This is not the practice on other elevated roads where tanks are generally placed under the structure to catch the drippings from both engines and cars; no special effort being made to retain either. There are no tanks upon or under the structure on this road; the drippings from the steam heating system under the cars and from the engines being collected in tanks and pans, which are fixtures on the cars and engines themselves and which are only emptied at terminals or at coaling stations.

All bolts are tapered 1-16 of an inch per foot and all nuts are fitted so that they must be turned on with a wrench.

The firebox and boiler steel were bought under a special specification and guaranty. All test pieces are eight in. long, and the elongation must be 25 per cent., with a tensile strength of 55,000 pounds per square inch, and must bend double without cracking at any heat. The firebox sheets have not over .02 per cent. of phosphorus. All sheets in the firebox are guaranteed against lamination for a period of five years. All material for the engines is purchased under special specifications, and the tests of the materials have been made by R. W. Hunt & Co., of Chicago.

The compound system of the engines is guaranteed in every respect, and so far the guaranty has been kept.

After these engines had been accepted and paid for, and after a considerable discussion with experts, including locomotive builders, who originally purposed

guaranteeing engines of the single expansion type to beat the compounds, it was decided that the Vauchain compound engine is best adapted to the work of the elevated road in Chicago. Dr. Barnard, the President of the road, has not, however, allowed the investigation of the relative merits of the two and four cylinder compound to rest at this point; but being satisfied that the final decision of builders of single expansion engines to compete against compounds has narrowed the practical field of investigation to two *versus* four cylinder compounds, and being anxious to get the most serviceable as well as the most economical, has given an order for one two-cylinder compound to the Baldwin Locomotive Works, with instructions to build it of the highest grade, its parts to be duplicates of the present engines wherever possible, and to be equal in action to any other two-cylinder compound in existence.

The more important features about these elevated road engines, which bring them up to the most modern type of construction, are about as follows:

The firebox, instead of being carried on links with expensive forgings and joints to wear, is supported upon one expansion pad on each side, as shown in the side elevation. This pad has a top and bottom bearing on the frame, as shown on the side elevation. The frames are made in one piece from end to end, and are made deeper over the truck to furnish a point of security for the transoms. The front rails of the frame differ from other elevated engines in being of the bar type instead of a slab frame, which requires steam tight joints for the cylinders. The boilers are of the radial stay type, with large fireboxes, and grate area sufficient to burn pea coal when necessary. The side of the tank and the cab is formed of the same sheet, the tank collar being flared only on the back. The tank extends under the cab, and in this way the weight is distributed as desired between the drivers and the trucks. There is no wood-work on the engines and no wooden moldings. The tank is the full width of the engine, and a running board of angle iron is provided underneath. All of the wearing parts are made as large as for an ordinary eight-wheel engine, and an endeavor has been made to give these engines, which make about 250 miles per day, an unusual durability. A number of small parts common to this class of engine have been removed as unnecessary. The flange under the firebox for making a tight joint to prevent ashes from getting to the driving boxes is shown. The large crank pin bearings, driving axles, and wearing surfaces of the link motion, are also shown in the cuts as are the guard rails, which all parts have to clear. The muffler shown was first put on, but is not now used.

If a fair comparison can be made between the fuel consumption per train mile in these engines and engines on other elevated roads, then the saving due to higher steam pressure, compounding, and to larger boilers and grates, is in the neighborhood of 40 per cent.; that is, if the comparison is made directly without allowances; but if allowance is made for the faster time on the Chicago elevated and for the increased weight of engine, the saving is considerably more. All of this saving, however, must not be laid to compounding. Much of it is undoubtedly due to the fact that the firebox is unusually large and the rate of combustion is quite slow for locomotive engines, although considerably greater than for stationary engines.

When the two-cylinder compound arrives it will be thoroughly tested in comparison with the four-cylinder engine in regard not only to the starting and hauling of trains and fuel consumption, but also with regard to the effect on the structure produced by the counterbalances. The work done by these engines more nearly approaches that done by the engines used on the Illinois Central suburban road than that of other elevated roads, owing to the difference in speed. In the *Railroad Gazette*, April 15 and June 10, 1892, there were given accounts of the variation in speed and acceleration of suburban trains. An examination of the diagrams there given, remembering that the maximum speed between stations on this road is 30 miles an hour, will reveal the reason for the increased work to be done to meet the Chicago elevated schedule.

Ohio Extension of the Norfolk & Western Railroad.

The Ohio extension of the Norfolk & Western Railroad, shown on the accompanying map of the system, and which has been building for about two and a half years, will be opened for through passenger traffic on Oct. 30, when a daily train service will be inaugurated. As most of our readers know, this new road connects with the line of the Norfolk & Western in the Pocahontas coal fields, and extends through the State of West Virginia for 190 miles to the Ohio River, at Kenova, the river having been bridged at that point, and connection made with the Scioto Valley division, which reaches Columbus, O., making a through line between Norfolk and Columbus of 707 miles. The new road follows the valleys of crooked streams throughout its entire length in West Virginia. It penetrates a wild country, which has heretofore been not only without railroad facilities, but practically inaccessible for wagon transportation, but with great possibilities of future develop-

ment in its rich coal and other mineral territory and thousands of acres of virgin timber.

The extension begins at Kyle, W. Va., near Powhatan, a station centrally located in the Pocahontas coal fields. From this point it follows down the valley of Elkhorn Creek to its confluence with Tug Fork of Big Sandy River at Welch, the county seat of McDowell County, a distance from the point of beginning of 14 miles. Thence the line follows down the valley of Tug River to the mouth of Pigeon Creek at Naugatuck, a distance from Welch of 85 miles. At Hatfield Bend the line crosses Tug River twice, the two crossings being one-quarter of a mile apart. At Naugatuck the line goes up the valley of Pigeon Creek for four and one-half miles, and thence up Laurel Fork of Pigeon Creek for a distance of ten miles to the Summit between the headwaters of Laurel Creek and those of Twelve Pole River at Dingess Station; thence the line follows down the valley of Twelve Pole Creek to the Ohio River at Kenova, a distance of 69 miles. From Kenova the line crosses the Ohio River and extends along the north bank to Coal Grove in the state of Ohio, a distance of 7.8 miles, and a total distance of 190.6 miles from Kyle, the southern terminus of the extension.

The grades may be considered as excellent when the rough character of the country is considered. The only opposing grade between the coal field and the Ohio River is for a distance 8 1/2 miles in the valley of Pigeon and Laurel creeks, the maximum of which is one per cent. for a distance of 5.6 miles. The grades south bound are equally favorable, the heaviest opposing grade between the Ohio River and the coal field being the ascent to the headwater of Twelve Pole River for a distance of two miles at 45 ft. a mile; both of the grades above referred to being compensated for curvature.

The valleys for the entire distance are tortuous, and in order to avoid too excessive curvature frequent crossings of the streams were necessary. This is best indicated by giving the number of times it was found necessary to cross the main streams, these crossings being as follows:

Elkhorn Fork, 13 times; Tug Fork of Big Sandy River, 10 times; Pigeon Creek, once; Laurel Fork of Pigeon, 4 times, and Twelve Pole River, 31 times.

The general character of the construction of the line may be considered as excellent, and this is particularly so as regards the culverts and bridges. Very careful studies were made of the water areas tributary to the various openings, and the openings were designed accordingly. Great care was taken to ascertain extreme high water in the various streams and it is felt that while the line is a valley line for its entire distance, but little trouble may be anticipated from the action of floods. Very great care was exercised in the selection of stone, and the masonry throughout may be characterized as first class both in design and construction.

The bridges were designed for heavy loading under the general specifications of the Norfolk & Western Railroad Company and were built and erected under competent superintendence and inspection. The line is laid with new rails weighing 67 lbs. per yard with 2,820 cross-ties a mile, and with the exception of the gap near the centre of the line which could not be fully ballasted previous to opening for business is well ballasted throughout with broken stone or gravel. The small portion of the line not fully ballasted is in good line and surface and the work of ballasting is being carried on.

There are eight tunnels on the line, four of these being at sharp bends on Elkhorn and Tug forks, one at the divide between the waters of Laurel fork of Pigeon and Twelve Pole River and two at sharp bends on Twelve Pole River, the principal tunnel being the one at the divide above referred to, 3,340 ft. in length.

The surveys for this line and the location were attended with many privations to the corps in the field, principally on account of the inaccessibility of the country. With the exception of a wagon road from the localities now known as Elkhorn and Welch, for a short distance in the vicinity of the station now known as Williamson, from points now known as Naugatuck and Lenore, and from the Ohio River about 40 miles up Twelve Pole River, there were actually no wagon roads, only the merest trails upon which one could ride. The writer of this article speaks knowingly and feelingly in regard to this, as he was on horseback 22 days in this country without a guide and in winter weather.

As a result of the 22-day trip above referred to the final location as selected was decided upon. Previous to this time the Norfolk & Western had for two or three years conducted surveys for an extension of its system to the Ohio River. The engineers in the field were obliged in moving camp to transport their outfit by the round-about and uncertain method of rafting upon the streams, by packing upon horses, by sledding with oxen, or, as was necessary in several instances, by packing their tents and other outfit upon their own shoulders. The line, as constructed and built, bears testimony to their faithful performance of duty under very adverse circumstances. The construction of the line was also for the same reasons attended with great difficulty, and the forwarding of supplies into the work was a serious and troublesome matter. However, the work has gone steadily on until the road is now completed and ready for operation.

In addition to the large amount of through business

which it is reasonable to suppose will pass over its line, connecting as it does the great Northwest with the sea-coast, it is anticipated that the natural resources of the country will afford a large and constantly-growing traffic; this principally in timber and coal. A glance at the map will indicate the large area tributary to this line and the small amount of branch line construction necessary to develop the country. A branch line 12 miles long from the Twelve Pole Summit will reach the Guyandotte River at Logan Court House and the upper Guyandotte can be made easily tributary by this means. It is not exaggeration to say that there are 30,000 square miles of practically virgin forest of walnut, poplar, beech, birch, white and chestnut oaks and hemlock tributary to this road and that the coal fields are so vast that they cannot be adequately treated in this article.

While we have described this line as the Ohio Extension of the Norfolk & Western Railroad, we have only referred to the connecting line recently built between the main system and the line in Ohio. In the movement of traffic the Ohio Extension of the Norfolk & Western may be considered as leaving its main line at Radford and extending thence to Columbus, O., a distance of 407 miles, the total distance from the sea coast at Norfolk to Columbus being 707 miles.

River, and extending across the Ohio River practically level, all of these piers being founded upon this bed-rock. The foundations were furnished to the contractors by the railroad company, and in every instance the coffer dams were pumped practically dry, and the foundation bared, cleaned and leveled for the reception of the masonry. The piers are built of sandstone and freestone of ascertained durability, and the masonry must be considered as absolutely first class throughout, nothing but large rectangular blocks, thoroughly bonded, having been used.

The masonry was built by Mr. W. F. Patterson. The superstructure was designed and built by the Edge Moor Bridge Works. The entire work from preliminary to ballasting has been done under the direction of the chief engineer, Mr. W. W. Coe.

The "New" Panama Canal.

A prominent writer, in a recent entertaining quip on the miscalling of things, instanced, of course playfully, that leading publication, which, notwithstanding our universal and life long acquaintance with it, still continues to put forth as the "New Monthly Magazine"; it would seem too much like a pun to comment on the fact that the "new" is the only old thing about it, but its publishers, we may be satisfied, know the value of the

mate the cost of completion at many times the sum now named as sufficient to rehabilitate the undertaking.

But it cannot be denied that many people, in France at least, do take the proposal seriously and are almost as ready as were their predecessors, the poor dupes of 1879, to be deprived of their substance, with no possible result beyond swelling the number of the victims and the already stupendous total of the loss.

Lieutenant Wyse, in 1891, estimated that it would cost not less than 600,000,000 francs additional to complete the canal upon the modified plans (using locks, the original project having been for a canal at sea level); this even if it were possible, would make the entire direct cash outlay 2,100,000,000 francs or more than \$400,000,000, not counting interest obligations or expenses of equipping and operating the canal and maintaining it until the traffic should become of sufficient volume to yield a return on operation. The Wyse estimate falling far short, as it manifestly does, of what would be required, is conservatism itself in contrast with that put forth most recently by the syndicate above referred to, which is in effect that 150,000,000 francs or \$30,000,000 will be sufficient to resume the work and complete the two most difficult parts of the work, namely, the disposal of the Chagres River and the opening through the Culebra Cut. With a craftiness born of the necessity of paying some tribute to the bitterly acquired knowledge of the old investors, they with great apparent frankness admit that all of the canal cannot be completed for the \$30,000,000, but only 28 miles out of the entire 47. What particular miles are to be thus completed in advance they do not specify; it is, however, well understood that with the exception of the first seven miles from Navy Bay, constituting the dredgable section, there are no parts of the canal that can be completed by horizontal advance, and that the unsolved problems of the Chagres River and the Culebra Cut cover practically the next adjacent 25 miles. On the Pacific side no work was ever done on the canal proper and the six miles of subaqueous blasting through the coral rock to carry sufficient depth of water to the mouth of the canal (and not included in the 47 miles) present difficulties of a kind too troublesome and costly to undertake in advance.

The only practicable results of the former work when it stopped were in the dredged channel below Gatun, in which it was claimed that 15 ft. of water could be found throughout its length of seven miles and over a width equal to about one-quarter of the canal dimension. This depth being only one-half of the ultimate requirement, it may be fairly said that when the work

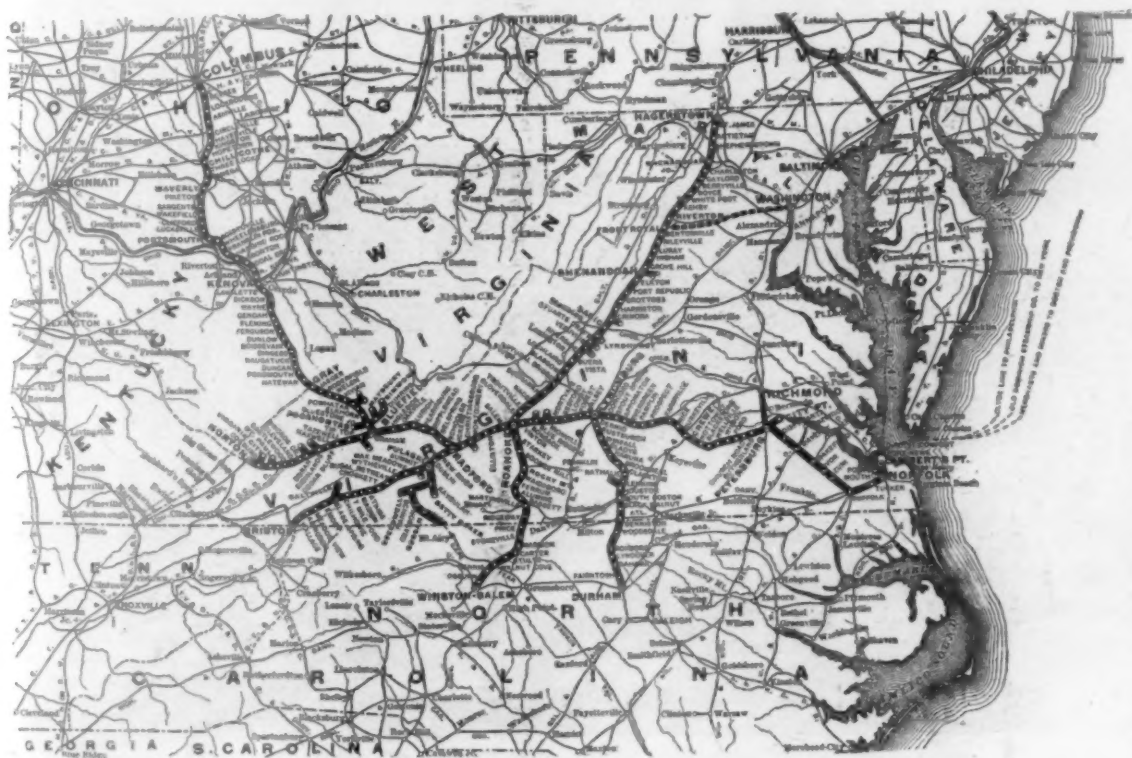
stopped seven miles were one-eighth finished, or that the equivalent of seven-eighths of one mile was completed. Since that time the vexing Chagres has many times overflowed its banks and washed into the narrow channel its enormous loads of silt; and this condition prevails largely on other parts of partly completed excavations, so that practically most of this work would have to begin literally *de novo*, and in this sense the title at the head of this note is not a misnomer.

At Culebra the work done, considered as an integral part of the cubic contents of the prism, was comparatively insignificant. The greater part of the vast sums that were spent flowed in other ways—for plant, in preparations, in houses and hospitals, for engines and machinery, for the Panama Railroad and for the dredging before referred to.

The stupendous plant, which in prodigality, inefficiency and multiplicity was the wonder of the world, is still there, or largely so; but it is no longer an asset nor can much of it again be put to useful service. The elements have done their fell work and the river and rains have wrecked and destroyed. The great dredges which did good work were sold two years ago and taken to Nicaragua, where they were put to work on Panama's great rival, all but the "De Lesseps," which foundered at sea while on the way to Greytown.

This story has been oft retold and it is hardly worth while to mention it here, except by way of emphasizing the fact that there is no physical basis for considering the Panama Canal as a partly completed work only needing a few million dollars more, judiciously expended, to finish it and enable it to fulfill a glorious destiny. In the expressive language of the day, the Canal is a "fake," or its French equivalent.

The real object of the \$30,000,000 which M. Hieland would not raise and which M. Bonnardel wants the promoters to raise in part, and which M. Paul Leroy-Beaulieu, a very judicious and well informed gentleman, says should not be raised, as it would be sending good money



MAP OF THE NORFOLK & WESTERN RAILROAD.

The Engineering Department of the road may refer with pride to the correctness and thoroughness with which the line has been located and constructed, great attention having been paid by the assistants in the field to the general standards and designs adopted and great care having been exercised in laying out the work and in the superintendence and inspection during its progress.

The length of this article will permit special reference to but two engineering features: one being the Summit Tunnel at the headwaters of Twelve Pole and the other the bridge across the Ohio River at Kenova.

The tunnel, 3,314 ft. in length, was built by those able and experienced contractors, Messrs. Mason, Hoge & Co., of Frankfort, Ky., in about two years. The tunnel had to be driven for a very considerable portion of the way in exceedingly bad ground, and this portion of the tunnel has been arched partly with stone and partly with brick and the engineers speak highly of the excellent quality of the work done.

The Ohio River Bridge, consisting of 2,200 ft. of viaduct approach, four spans of 304 ft., and of one span of 502 ft., both as regards masonry and superstructure is considered by experts excellent in both design and construction. The masonry is for a double track and the trusses are set far enough apart so that the bridge itself is adapted for double tracking in the future by the addition of a central truss. The viaduct approaching the bridge from the South is also arranged to admit of double tracking without any change in the parts as erected. The surveys for and location of the river spans were most carefully conducted in exact conformity with the law governing these matters and the location of the channel span was studied from a navigation standpoint. As a result the plans as submitted were approved by the Engineering Commission appointed by the Secretary of War without the slightest change.

The rock at the point selected for the crossing was found at a depth of 9 ft. below low water in the Ohio

adjacent as a coin, and the public understands that it means ever new.

The restless Paris clique, or *claque*, who, notwithstanding all, seem seeking ever to turn a dishonest franc, having long ago abandoned *à niveau*, have now adopted the potent *nouveau* as a trade-mark for their worn out wares, the stocks of the Canal Panama; and strange to say, judging from the interest excited by their spasmodic but forceful efforts, the credulous public seems not averse to be induced to believe and to invest their money in the new enterprise, blind to the fact that there is but one Panama and that one the dishonored grave of 1,500,000,000 francs, buried without result and with absolutely no hope of resurrection.

As late as the 8th of the present month the following dispatch was cabled from London and appeared in the newspapers here:

"After some wavering M. Hieland, Vice-President of the Paris Chamber of Commerce, has decided to give up the management of the New Panama Canal syndicate, projected to undertake with a capital of 150,000,000 francs the completion of the work. M. Hieland regards the task of reconstructing the Panama Canal business as hopeless."

So far so good, but the dispatch goes on to say:

"Pressure is being brought to bear upon M. Bonnardel, President of the Rhone Navigation Company, to induce him to accept the management. He is inclined to undertake the task, provided that the friends of the project will come forward immediately with funds necessary for initiating the undertakings. The appeal to the public, he says, should not be made for some time."

It is impossible for any one at all well informed on the actual condition of the canal works at the time of their abandonment in hopeless ruin to take these propositions seriously, especially as during the five years that have elapsed intelligent French commissions, sent out in the interests of the Canal Co., have time and again reported adversely to resumption, while even the sanguine and presumably biased adherents to the undertaking, who are technically competent to do so, esti-

after bad, but if it be raised at all it must be by private subscription,—is not to complete the Canal, but simply to keep alive the Colombian Concession some years longer, as everybody knows, and let a number of Canal promoters down, gently and easily, who, a short while ago, were living in momentary apprehension of unpleasant action under French civil process, relating to misapplication of funds.

As an engineering achievement neither the old nor the "new" canal has ever had the remotest chance of success, simply because of the overwhelming magnitude of the work, which puts it as a mere physical matter outside the pale of commercial feasibility at this period of the world's development. Moreover, as if that were not enough, and although there have been many able and gifted engineers associated with the work, some of whom have laid down their lives upon it, it has never been approached from the engineer's standpoint, whose aim is to remove or overcome obstacles but not to proceed in reckless defiance of them. FOSTER CROWELL.

NEW YORK, Oct. 19, 1892.

Pecos River Bridge.

We print herewith an engraving, reproduced from a photograph, of the high bridge of the Southern Pacific

Annual Meeting of Bridge and Building Superintendents.

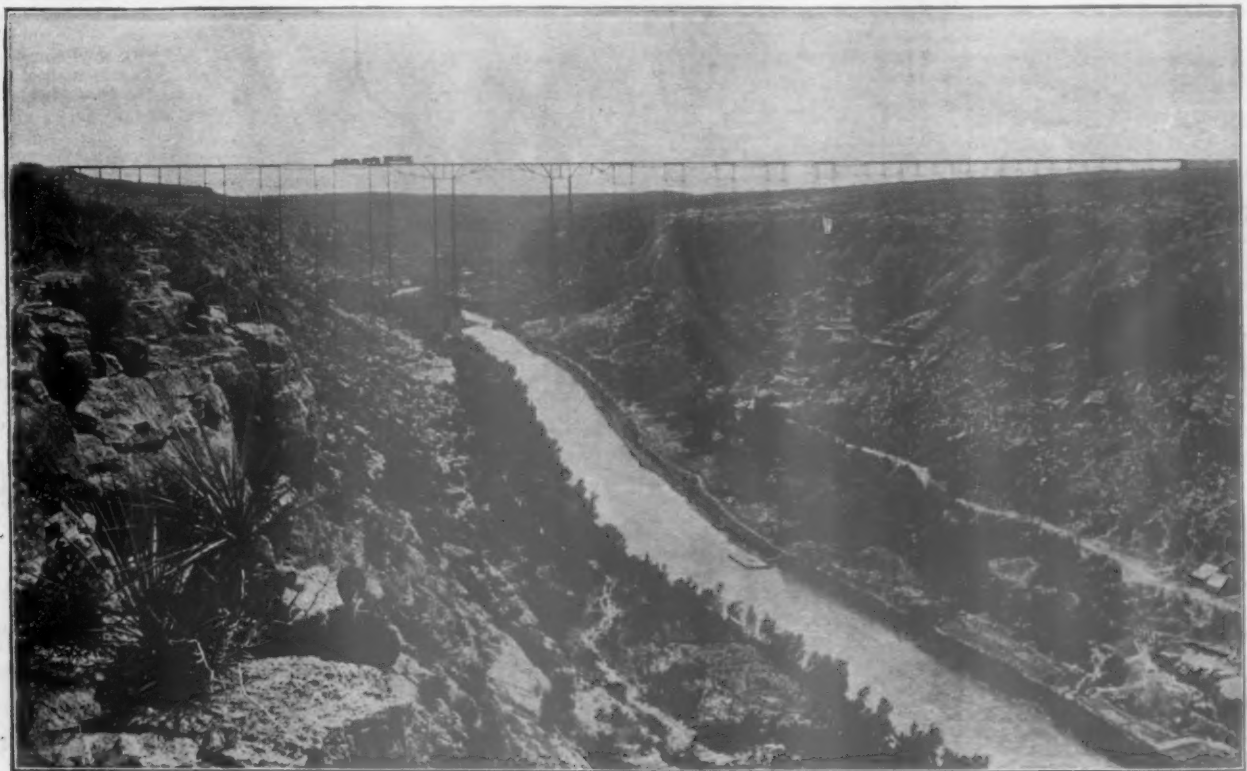
The second annual meeting of the American International Association of Superintendents of Bridges and Buildings was held at Cincinnati, Oct. 18-19, about 40 members being present. This society was formed last year, but has never before held a meeting for discussion. It has now about 150 members, of whom about one-third joined this year. Most of the membership is from the roads in the central states, in which territory most of the important lines are represented. There are also a good many from the South and a few from the East and the Pacific coast. The first half day was chiefly occupied in electing new members, appointing committees and other routine business. Mr. O. J. Travis, of Marshalltown, Ia., President for the first year, was unable to be present on account of sickness in his family, and the chairman of the meeting was Mr. H. M. Hall, of the Ohio & Mississippi, Vice President.

Subjects for discussion next year were announced, and committees were appointed for the ensuing year as follows, the name of the first member on each being named after the subject:

1, "Discipline, Benefits Derived and Who Are the Beneficiaries," Geo. W. Andrews; 2, "Turntables," G.

the whole, the surface guard affords the greatest security and is most easily taken care of. This report was "received," but there appears to have been no formal discussion. Later in the meeting, Mr. A. S. Markley made a report favoring the ordinary pit cattle guard. Such a guard should be made of 6 x 8-in. sleepers, 9 ft. long, laid edgewise, and chamfered. The stringers should be 12 in. square, and the wall plate should be made of 12-in. timbers, sufficient to make a pit 31 in. deep. The wing fence should run parallel with the track the length of the guard. With an opening of 8 ft. animals will not try to cross. The material for a guard of this kind costs about \$14, and the labor of putting in about \$5. The framing should be done in the shops. None of the iron surface guards have proved themselves sufficient barriers. In case of derailment, the damage is greater than to a pit guard, and the first cost is \$25, as compared with \$19 for the pit. The liability of a dragging brake rod to tear up an iron guard is a considerable danger.

Mr. W. R. Damon, of the Louisville, Evansville & St. Louis, another member of the Committee, made a brief report, saying that he had not found a perfect surface guard. Extended tests will be necessary to decide between the different styles. On the whole, Mr. Damon is inclined to favor a wooden guard, with end sills, solid stringers, 6 x 8 in. ties and guard rails. They are cheap



PECOS RIVER BRIDGE—SOUTHERN PACIFIC RAILWAY.

In Western Texas, 781 miles from New Orleans.

Railway over the Pecos River, Texas, which was completed early in the present year. This bridge is 323 ft. high and 2,080 ft. long, being one of the two or three highest bridges in the world. This photograph was taken for the Hall Signal Co., to whom we are indebted for the use of the plate, which was made for use in a catalogue issued by that company. The illustration is shown in the catalogue for the purpose of calling attention to the fact that Hall wire circuit block signals are used to protect the section of road in which the bridge is included. This section is 5½ miles long and the signals are controlled by an operator who is located three-quarters of a mile beyond one end of the section. The operator is apprised of the approach of trains by track instruments located a half mile outside the beginning of the block section, so that the furthest track instrument is 6¼ miles from him.

It will be of interest to recall the main features of the bridge, which was built for the Southern Pacific by the Phoenix Bridge Co. for the purpose of shortening the main line and reducing the grades as well as avoiding other difficulties incident to maintaining a railroad in the cañons of the Rio Grande. There are 48 spans alternately 35 ft. and 65 ft. long, except the channel span, which is a cantilever 185 ft. long. The towers, the highest of which are steel, rest on masonry piers. They are 35 x 100 ft. at the base and 35 x 10 ft. at the top. The highest tower is 321 ft. high, including the masonry. The floor of this bridge is covered with galvanized sheet iron as a protection against fire, 32,500 sq. ft. of iron having been used for the purpose.

The Zone System.

The bill for the introduction of the Zone system of fares on the railroads of New Zealand has been dropped at the end of the session of the Colonial parliament. It was strongly opposed in the upper house.

W. Markeley; 3, "Water Columns," C. E. Fuller; 4, "Coaling Stations," J. E. Wallace; 5, "Crawling of Rails and Its Effect on Structure," Geo. M. Reid; 6, "Guard Rails on Bridges," O. J. Travis; 7, "Platforms (Height and Distance from Rail and Mode of Construction)," James Stannard; 8, "Best Bridge—Wood, Combination or Iron," A. Shane; 9, "Best Method of Elevating Track on Bridges or Trestles," H. E. Gettys.

Mr. G. M. Reid made a brief address on the subject of painting iron bridges. He finds in many iron ore paints phosphorus and sulphur, which damage the iron. Asphaltum paints often contain so much benzine that after drying the surface is left rough, affording a lodging place for sulphur from locomotives and moisture from the atmosphere, causing oxidation of the metal. Many prepared paints are too viscous and have to be thinned, so that they lack durability. On the whole the speaker preferred pure linseed oil and lead, so colored as not to absorb heat. All iron in bridges should be first coated with boiled linseed oil. In warm weather this can be put on so as to cover all the inequalities of surface, and in cold weather the oil should be put on so it can reach all the inequalities. When two or more pieces are to be riveted together each surface should receive a coat of paint carefully applied in the shops, then when the structure is erected it should receive two coats of lead and oil paint of some light gray or stone color. Before painting, all places where rust has taken place should be thoroughly cleaned. Experience shows that bridges cared for in this manner have been more economically maintained than those painted with other than lead and oil paints. This paper was "adopted" by the convention.

Mr. J. B. Mitchell, of Indianapolis, from the Committee on Cattle Guards, made a report detailing the merits and demerits of pit and surface guards. He spoke favorably of the test made at Brightwood, Ind., and held that, on

and will last from 6 to 12 years, and in cases of derailment are not usually destroyed. Metal guards are more expensive, and in cases of bad derailment are totally destroyed. They are made of light material and rust away unless carefully preserved with paint.

The Committee on Frame and Pile Trestles made a report, discussing the construction and maintenance of these structures. The majority of roads, so far as the Committee can learn, make the important joints with a mortise and tenon. This is the best joint but requires accurate and high priced work. The fact that the mortise affords a receptacle for water is, however, a marked disadvantage. Where this joint is used the thickness of the tenon should be equal to one-third of the thickness of the timber. All of the weight or strain should be carried by the shoulder, and in the case of batter posts, where the timbers are not at right angles, the resulting thrusts must be taken by the boxing or daping of the caps and not by the tenon. One good method of obviating many of the defects in mortise and tenon joints is by the use of double caps for posts and sills. That is, in the place of 12 x 12 in. timbers two timbers 6 x 12 in. can be used; being properly fitted and securely bolted together they not only give good results as to strength and durability, but expose defects, frequently found in the centre of large timbers. The timbers being of only one-half the size and weight can be handled much more rapidly, and renewals are made much easier. Especially is this the case where trains are to be carried during the renewals.

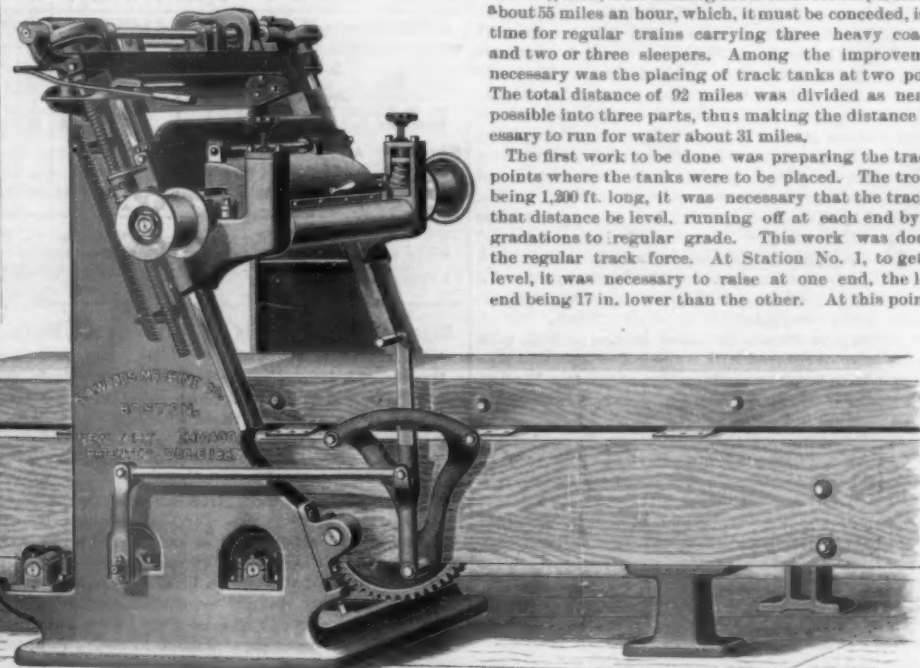
The use of dowels is cheap in first cost, but it does not give a rigid joint, and the work of renewal is more difficult. Drift-bolts afford the simplest and cheapest means of fastening a joint, and this plan is therefore the best for temporary work. Bent metal plates have been used to some extent with satisfactory results. These plates are of thin boiler iron, generally ¼ in. thick.

These plates, $\frac{1}{2}$ in. \times $2\frac{1}{2}$ in., and 5 ft. long are being used by some of the best roads. The best method of securing the bracing of a trestle is by $\frac{1}{2}$ in. round bolts with cast iron headers and washers and a nut lock.

Many trestle floors are weak; the stringers are too light, and the ties too small and too few. Stringers should be made of two or more pieces of timber properly packed with cast iron blocks not less than one inch thick. Each stringer should cover two panels or spans and they should break joints. The panels of a trestle should not be over 15 ft. long. An outside stringer half as large as the track stringers should be used for the best work. This should come directly under the guard timber, which should be bolted to it. A bridge floor should be built to carry a derailed car across in safety. The ties should not be over six inches apart, not less than 8×9 in. in section and 12 ft. long. The guard rail, 8×10 in., should be notched one inch so as to receive each tie to that extent, and every fourth tie should be bolted. These bolts should be carefully watched and kept well tightened. There should be a re-railer at both ends of every bridge. It should guide the wheels back to the track in the shortest possible space. It should be simple in design and permit of tamping the ties. It should not require cutting away and weakening of the ties on which it is placed.

The committee on Iron and Vitrified Pipe for Water Ways, James Stannard (Wabash), J. E. Wallace (Wabash), and J. O. Thorne (Chicago, Burlington &

field, Ill.; Third Vice-President, N. W. Thompson (Pennsylvania), Fort Wayne, Ind.; Fourth Vice-President, C. E. Fuller (Terre Haute & Indianapolis, Terre Haute, Ind.; Secretary, S. T. Patterson (Concord & Montreal), Concord, N. H.; Treasurer, G. M. Reed (Lake Shore & Michigan Southern), Cleveland, O. Executive Committee: G. W. Andrews (Baltimore & Ohio), Philadelphia; J. Staten (Chesapeake & Ohio), Richmond; J. M. Caldwell (Louisville, New Albany & Chicago), Crawfordsville, Ind.; Q. McNab (Cleveland, Cincinnati, Chicago & St. Louis), Terre Haute, and A. S. Markley (Chicago & East, ern Illinois), Danville, Ill.



GIANT DIMENSION PLANNER.

Quincy) made a report favoring the use of cast iron pipe. Vitrified pipe will not withstand the action of frost where exposed at the ends, and will crack even if protected by masonry. The greater number of joints is also a reason for classing this as an inferior to iron pipe. The outer ends of a pipe under an embankment should be always well protected with masonry laid in cement mortar, and on the down-stream end an apron should be provided to protect the embankment. The committee is informed that iron pipe put in on the Fitchburg road in 1878 is still in a good state of preservation. The Wabash has adopted the use of cast iron pipe, and the Atchison, Topeka & Santa Fe uses it largely. Vitrified pipe is very suitable as a substitute for wooden sluice boxes, as it is more durable and cheaper than wood. This report was "accepted."

Mr. J. H. Markley (Toledo, Peoria & Western), a member of the committee on Howe Truss and other wooden bridges, made a report giving some of his experience with that kind of bridges. The records of a number on his road showed the average life to be 7½ years. The cause of removal in each case was decay, which affected chiefly the lower chords, clamps and packers. Better protection from water would have prolonged the life of these bridges, and such protection is best secured by the use of galvanized iron. The custom of housing wooden bridges has proved dangerous, as engines will throw fire up into the roof. Iron covering should be used for the chords only, running it under the angle blocks and gib plates. The cost is nominal, taking into consideration the length of life it adds to the structure. A record of covering the chords in this manner shows it to cost $11\frac{1}{2}$ to 15 cents per lineal foot. Mr. Markley continued: "I have on my line one bridge with the stringers covered with No. 26 galvanized iron. It was put on in 1885 at a cost of 17 cents per lineal foot of bridge, and the stringers are as good now as when put in. I find only one objection to this; the hard oak ties have a tendency to cut or break the iron at their edges."

"Concerning the best method of framing and packing Howe Truss Chords, very little improvement in framing is possible if the workmanship is close. In packing, I use iron and would not use anything else. Two years ago I removed a 97 ft. span built in 1878, it having had a life of 12 years. The chords were packed with wood, and the clamps were iron. The chords were perfectly sound when taken out, except where they came in contact with the wood packers, at which place they had decayed to a depth of from one to two inches, a condition not found to exist where iron packers are used. The timber used in this span was long leaf Southern pine. I use it in all cases for my chords, as I consider it far better and stronger than Northern pine."

The first business for Wednesday was the election of officers, which resulted as follows:

President, H. M. Hall (Ohio & Mississippi), Olney, Ill.; First Vice-President, J. E. Wallace (Wabash), Spring-

field, Ill.; Third Vice-President, N. W. Thompson (Pennsylvania), Fort Wayne, Ind.; Fourth Vice-President, C. E. Fuller (Terre Haute & Indianapolis), Terre Haute, Ind.; Secretary, S. T. Patterson (Concord & Montreal), Concord, N. H.; Treasurer, G. M. Reed (Lake Shore & Michigan Southern), Cleveland, O. Executive Committee: G. W. Andrews (Baltimore & Ohio), Philadelphia; J. Staten (Chesapeake & Ohio), Richmond; J. M. Caldwell (Louisville, New Albany & Chicago), Crawfordsville, Ind.; Q. McNab (Cleveland, Cincinnati, Chicago & St. Louis), Terre Haute, and A. S. Markley (Chicago & East, ern Illinois), Danville, Ill.

The committee on Water Supply made a report signed by G. W. Turner (St. Louis & San Francisco) and Quintin McNab (Cleveland, Columbus, Cincinnati & Indianapolis). The report opened with a criticism of those general managers who too rigidly limit the appropriations for this department each year without regard to the magnitude of the work undertaken. It often happens that an important improvement is left half done, and the excessive cost of temporary supply is enough to have finished the job in one year. The main point in constructing reservoirs is to make them of sufficient capacity and deep. Some expensive reservoirs have proved useless because they are too shallow. The committee prefers steel water tanks to wooden ones, believing that their durability more than offsets the additional cost. Wrought or cast iron frames should be used even if the tanks are of wood, where wooden frames will not stand over 10 or 12 years. The space between the double walls of the roof and around the pipes under a tank should be left empty and not filled with sawdust or other substance to hold moisture. Pump and coal houses should always be made of brick, with fire proof roofs. The additional warmth and durability soon repays the extra cost. The committee makes no decided recommendation concerning pumps, but the Chairman, who has watched various kinds for 20 years, prefers the Worthington or the Blake.

On Wednesday afternoon Mr. George W. Andrews, of the Baltimore & Ohio, read an interesting article on Track Tanks, which is printed in another column. The next meeting will be held in Philadelphia.

"Giant" Dimension Planer.

The S. A. Woods Machine Co., of Boston, has recently designed and perfected the machine shown here for squaring and truing up timber of large dimensions. It combines features that make it a desirable machine for car shops, bridge building, etc. It takes work 30 in. wide and 24 in. thick. It has a quick return feed and a power hoist for the cylinder.

The central iron frame work carries all working parts of the machine, and the cutter-head, feed works, etc., are thus upon a substantial foundation. The ways are dependent for support upon the iron work. The cutter-head is made with forged steel body and crucible steel journals of large diameter running in long boxes connected by a heavy yoke. It is square, slotted on four sides, and cutters can be attached for chamfering, heading, etc. Suitable pressure rolls are placed before and after the cut. The entire cutter-head attachment is raised or lowered by power.

All bearings are provided with self-oiling boxes and all parts are readily accessible for oiling. The idler trucks, on which the platen travels, reduce the friction to a minimum. The cutter-head pulleys are 6 in. diameter for 5 in. bolts.

Track Tanks on the Baltimore & Ohio.*

In 1890, the Baltimore & Ohio adopted a very fast schedule for the trains running between Philadelphia and Baltimore on their Philadelphia division, the time being 1 h. 47 min. for a distance of 92 miles. The actual running time, after making deductions for stops, etc., was about 55 miles an hour, which, it must be conceded, is fast time for regular trains carrying three heavy coaches, and two or three sleepers. Among the improvements necessary was the placing of track tanks at two points. The total distance of 92 miles was divided as near as possible into three parts, thus making the distance necessary to run for water about 31 miles.

The first work to be done was preparing the track at points where the tanks were to be placed. The troughs being 1,200 ft. long, it was necessary that the track for that distance be level, running off at each end by easy gradations to regular grade. This work was done by the regular track force. At Station No. 1, to get this level, it was necessary to raise at one end, the lower end being 17 in. lower than the other. At this point we

have a double track through truss bridge of 115 ft. span, which we were compelled to raise the 17 in. Station No. 2 was placed on a fill, where the grades formed a dip of about 4 ft., the grades being about 10½ ft. to the mile.

The grade being leveled, the hewn ties were taken out and replaced with sawed ties, 8×9 in. white oak. These were dapped $1\frac{1}{2} \times 10$ in., working each way from centre of ties, to form a seat for the troughs. The troughs were made of sheet steel $\frac{1}{4}$ -in. thick, 15 ft. long. They were 6 in. deep, 10 in. wide, with a $1\frac{1}{2}$ in. \times $1\frac{1}{2}$ in. angle riveted to each side $1\frac{1}{2}$ in. from the bottom. This rests directly upon the top of the ties and forms the means by which the troughs are fastened to the ties, the fastening being done by an ordinary track spike, allowing the head to catch on the small angle mentioned. This allows the troughs to expand or contract. The troughs are fastened firmly at their centres so that they will be stationary at that point, allowing for expansion at the ends.

The troughs were made in 30-ft. sections in the shop. In laying them each joint was red-leaded, and cold riveted with $\frac{1}{2}$ -in. rivets, 20 to the joint. At each end is placed an inclined plane, with a total length of 13 ft. 8 in.; the inner end of this is riveted to the bottom of the trough and the outer end fastened to the timber by means of rail spikes driven on the edge of the plate, with heads of spikes resting thereon, thus allowing for expansion of the trough. The object of this plane is to force the scoop on tender of the locomotive up into position should the fireman fail to raise it, thus preventing any damage to either the scoop or trough.

The water supply must be governed by the location of the station. At station No. 1 we were compelled to construct a dam six feet high and about 75 ft. wide across the stream at that point. From this the water is drawn through six-inch cast iron pipe a distance of 600 ft. by means of a steam pump and forced into a 40,000 gallon tank placed 28 ft. above the track.

At station No. 2 the supply is received from a mill race about 600 ft. from the pump house. From this race the water flows by gravity to a filtering well at the pump house and from this it is forced by a steam pump into a 30,000 gallon tank, 28 ft. above the track. These tanks are kept full at all times. From the elevated tanks the water is delivered to the track troughs in the following manner: An eight-inch cast iron pipe is connected to the elevated tanks, and run to a point at or near the pump, where it is reduced to six inches. At this point is placed a six-inch gate valve. The supply pipe, running direct to the trough, branches off to three points by means of tees, reduced at point of leaving valve to $3\frac{1}{2}$ in. Two of the branches are connected to the troughs at points 200 ft. from the ends. The third one is connected to the centre of the trough.

At the points of connection of the water-pipe to the

*Paper read by G. W. Andrews, of the Baltimore & Ohio, at the meeting of the Association of Superintendents of Bridges and Buildings at Cincinnati, Oct. 19.

trough there is built a pit the full width of the track, about 3 ft. wide and 3 ft. 6 in. deep, with side and end walls of masonry; the top is covered with 2-in. plank and the bottom drained to one side. Into these pits the pipe is run, and it is connected to the trough by means of a 3/4-in. pipe flange, nipple and expansion joint.

The expansion joint used at this point is one of our own design, and I believe the first iron joint used for this purpose. (Some of the Eastern roads use a gum hose in place of an expansion joint.) In our two years' experience we have made no repairs to these joints. At this point is placed a 3/4-in. globe valve for use in emptying the troughs for cleaning or repairing.

One of the most important questions to be dealt with, in the use of these tanks, is that of keeping them free from ice during cold weather. To do this a 2 1/2 in. pipe is connected to the steam dome on the boiler, whence it is carried to the centre of the tracks, where it is double track, or to the end of ties on single track. There the pipe is reduced to 2 in., and run to a point 5 ft. from the end of the trough. On this pipe at intervals of 45 ft. is placed a cross, from which a 1 in. pipe is carried to the troughs. This connection is made with a nipple of extra strong pipe, cut 3 in. long, tapped out at one end and plugged with a hole 1/2 in. diameter inclined down. Immediately back of this nipple is placed a 1 in. check valve to prevent the back flow of water when steam is turned off. The 2 in. pipe in the centre is drained from both ends with a drain cock placed at the lowest point. To prevent breakage through expansion or contraction, expansion joints were placed at intervals of 300 ft.

All steam pipe should be boxed in and packed with mineral wool or covered with magnesia or asbestos pipe covering, to reduce the condensation of steam. We find the pressure of steam necessary to prevent freezing in coldest weather to be about 80 lbs.

During the warm months, when steam is needed for pumping only, we use an upright boiler of 25 H. P. During cold months, when it is necessary to have live steam constantly in the troughs, we use an old locomotive boiler of about 95 H. P. at one, and at the other one of 80 H. P. (the smaller would answer for either place). Each pump is, of course, connected to both its boilers.

At these, as well as at all other water stations on the Philadelphia Division, we use a No. 9 Blake pump, with a capacity of 200 gallons a minute.

At the end of a trough nearest the approaching train is placed a signal similar to a high switch stand. This is to notify engineer and fireman where to lower the scoop. At the distance of 100 ft. from the far end is placed a similar signal, at which point the fireman is supposed to raise the scoop, providing he has not filled his tank before reaching that point.

I mentioned that a 6-in. valve was placed in connection with the supply pipe at or near the pump house. Over these valves is built a small valve house, with floor about on a level with the track. After an engine has taken water these valves are opened and water allowed to run into the trough for from four to six minutes. When we first put these tanks in use there was considerable complaint that troughs were often not more than two-thirds full. On investigation I found that freight trains running over the troughs had thrown out considerable water by the current of air caused by the passage of the cars. I then instructed the pumpers to inspect the troughs five minutes before schedule time of trains, to see that they were properly filled; and to remain in the valve house from that time until after the train passed.

The elevated tanks are built in "frost proof" style, circular in form with hexagonal roof, covered with slate. The staves and bottom are of 3-in. white pine, the whole bound by 11 hoops of 3/4 x 4 in. iron.

As is well known, there is placed on the tender an oblong spout with a hinged scoop on its lower end. This scoop is connected to a lever on the forward end of the tender. When the engine reaches the trough the fireman throws this lever back, causing the scoop to drop about 3 in. The speed of the engine causes the water to flow through the scoop and spout and up into the tender. Engines often take water running at the rate of 45 miles an hour.

Cost.—The cost, complete, of No. 1 tank (for two tracks) at Swan Creek was:

Preparing roadbed.....	\$1,094
Labor (placing trough, running pipe, etc.).....	2,135
Troughs (including all shop work).....	4,159
Hauling.....	61
Material (including ties, pipe fittings, pipe).....	2,939
	\$10,388

"Labor" includes all labor in the field except grading. Included in the above cost is the running of about 75 ft. of 8 in. cast iron pipe and placing two stand-pipes for the use of freight engines. The cost of Station No. 2 was:

Preparing roadbed.....	\$2,767
Labor (placing troughs, etc.).....	1,549
Troughs (including all shop work).....	4,159
Hauling.....	30
Material (including ties, pipe fittings, etc.).....	3,080
	\$11,535

Included in this cost is the running of 600 ft. of 8 in. cast iron pipe and the placing of two stand-pipes for use of freight engines.

Cost of operating each station per month:	
Two pumps, \$45 each.....	\$90.00
Coal, per month, 15 tons (average).....	22.50
Ordinary repairs.....	20.00
	\$132.50

NEW YORK & BROOKLYN BRIDGE CABLE RAILWAY.

Summary of operations during the week including the Columbus Festival.

Day.	Date.	Length of time the train ran.	Number of round trips of trains and their headways.												No. of single cars on round trips.	Av. No. of cars per train.	Passengers carried.		Passengers carried the same day of the preceding week, Oct. 2-8.			
			Headway—minutes.										Average headway	Total No. of trains			Number.	Av. per car				
			15	7½	6	4	3	2½	2¼	2	1¾	1½										
		H. Min.	15	7½	6	4	3	2½	2¼	2	1¾	1½	Min. Sec.					Num'r.	R'tio			
Sunday...	1892 Oct. 9	21 0	91	..	1	39	152	48	12	180	..	..	3	11	483	1,652	3.65	92,309	30	81,018	1.21
Monday...	Oct. 10	22 32½	5	16	1	15	64	90	144	32	72	120	3	39	549	2,098	3.82	188,677	45	167,122	1.13	
Tuesday...	Oct. 11	22 45½	9	16	1	15	70	..	184	51	..	212	2	27	556	2,111	3.81	158,085	37.4	120,794	1.32	
Wednesday...	Oct. 12	24 0	4	10	1	15	68	..	40	213	..	..	2	4	607	2,622	3.76	223,625	42.6	102,790	2.04
Thursday...	Oct. 13	24 0	..	..	..	36	133	180	12	39	24	200	2	18	624	2,333	3.82	144,842	30.4	112,464	1.29
Friday...	Oct. 14	24 0	9	16	1	15	213	72	..	..	..	200	2	44	588	1,981	3.67	123,413	32	116,479	1.06
Saturday...	Oct. 15	24 0	9	16	1	15	188	75	90	120	2	45	594	1,943	3.71	153,588	39.5	162,066	0.95
For the week...		165 17	67	74	6	150	898	465	302	505	186	1192	2	31	3,931	14,741	3.75	1,091,530	57.	880,163	1.23	
b																						
From 8:15 A. M. Wednesday, Oct. 12, to 8:15 A. M. Thursday, Oct. 13		24 0	..	..	..	36	28	12	12	352	24	406	1	50	770	3,032	3.94	258,563 ^c	42.6		
b																						
From 8 A. M. Wednesday, Oct. 12, to 12:30 A. M. Friday, Oct. 14..		43 39	..	..	..	51	161	180	52	252	24	516	2	64	1,396	4,996	3.87	358,913 ^c	36.6		

a To permit displays of fireworks, trains did not run 1 h. 28 m. Monday evening, and 1 h. 15 m. Tuesday evening.

b The trains usually sent out from Brooklyn by cable, from 5.0 A. M. to 12.30 A. M., that is, 19 h. 30 m., and by locomotives the remaining 4 h. 31 m. In this instance the trains were hauled continually by cable 43 h. 39 m.

c Estimated.

Brooklyn Bridge Traffic in the Columbus Week.

During the Columbus Festival in New York, the various lines of transportation leading to the metropolitan district, as well as those within its boundaries, were obliged to carry a largely increased number of passengers, as compared with their ordinary traffic, and at times within quite limited periods. Certain particulars of this traffic were given last week in the *Railroad Gazette*.

What was successfully done on the New York & Brooklyn Bridge Cable Railway in moving the congested masses of humanity is shown in the following summary of operations of the week which included the Festival. On this railroad trains of from two to four cars each are run on headways of from 15 to 1 1/2 minutes, varying to best accommodate the fluctuations of travel. Usually the cable runs from 5 o'clock a. m. to 1 o'clock a. m. following, or 30 hours, and the last train during this interval hauled by cable is dispatched from Brooklyn station at 12:30 o'clock a. m.; during the remaining 4 hours and 21 minutes of the day of 24 hours the trains are hauled by locomotives.

To carry the crowds offering on Wednesday and Thursday, Oct. 12 and 13, the cable was run continuously for 44 hours, and trains of from two to four cars each, averaging 3.87 cars, were run on headways from 4 to 1 1/2 minutes, averaging 2 1/2 minutes. During the 24 hours beginning at 8:45 o'clock a. m., Wednesday, 770 trains were run, on an average headway of 1 1/2 minutes, and 258,563 passengers were carried—or nearly one-fourth as many as were carried on the day of greatest travel over the five elevated railroads in New York, constituting the Manhattan Railway system.*

For comparison, the numbers of passengers carried on the days of the preceding week, Oct. 2 to 8, are given in the table showing what is the ordinary traffic, at this time. Each day during the two weeks was fair. From this, it will be seen, that the increase in travel due to the Festival, began on Saturday, Oct. 8, and continued for one week; the greatest increase was on Wednesday, Oct. 12, when 223,625 passengers were carried, more than twice as many as on the same day the week before, and over 40 per cent. more than had ever before been carried in one day on the railroad.

The operations here recorded illustrate the extreme flexibility of a cable railroad system. During the period covered there was no halt or failure of the driving mechanism, and the increase in demand for hauling power was much less, comparatively, than the increase in traffic handled. The reliability of the driving mechanism employed was, however, but one element, contributing to the success of the work done; the discipline, vigilance and efficiency of the employees operating the railroad constituted another element fully as important; a few served 26 hours continuously, more 24 hours, and most of the others 19 hours,† all with entire willingness and a strong personal desire each to perform faithful and effective service.

Rapid Transit in London.

In the *Quarterly Review* (London) there appears an article which we judge to be by Mr. W. M. Acworth, discussing at considerable length the question of rapid transit in London. After the old fashion, this article is ostensibly a review of several recent books and documents. Among these are, Kemmann's "Der Verkehr Londons,"

*Per circular note, issued by Col. F. K. Hain, General Manager of the Manhattan Railway, to the officers and employees, deservedly commending their efficiency, 1,075,537 passengers were carried on Wednesday, Oct. 12.

† Ordinarily, so long a continuous service would be unwise; in this instance, it was better to so employ experienced and disciplined men, rather than to add to the force a large number of others necessarily untried and ignorant of their duties.

Troske's "Die Londoner Untergrundbahnen," Clarke's *Scribner's Magazine* articles on "Rapid Transit in Cities" and a batch of blue books and reports. We may as well say at the outset that it is merely an amiable fiction to pretend that the article is really a review of these publications. To get a notion of the present traffic in London and its probable development, and of the existing facilities for handling it, and of those which must be provided before long, the writer undertakes an independent investigation.

He finds that within a radius of six miles of Charing Cross there are 270 miles of railroad and 255 stations; within 12 miles there are 400 miles of railroad and 391 stations, but as a large part of these railroad lines and stations are used by more than one company, he estimates that if each station within the 12 mile area were counted separately for each company using it, the number would be increased to 630. He divides the railroads considered into two classes; the purely local and the lines of the great companies having termini in the metropolis. The local roads carried passengers last year as follows: The Metropolitan, 75 millions; the Metropolitan District, 30 millions; the North London, 30 millions; the City & South London, five millions; the East London and others, nine millions; total, 158 millions. By a process which may or may not be accurate, but which probably gives too small a result rather than too large, the reviewer estimates that the season ticket holders would add 19 million journeys to the above, making a grand total of 177 million passenger journeys on the local lines in a year.

He estimates the London passenger traffic for the great companies having termini in that city at 150 millions, giving a gross total for the railroads of 327 million passenger journeys. The journeys by other public conveyances for the year are put down as follows, with the railroad total given above:

Railroad passengers.....	327 millions.
Omnibus passengers.....	200 "
Tramway passengers.....	250 "
Cab and steamer passengers.....	50 "

Total..... 777 millions.

Dividing this by 4 1/2 millions, the number of inhabitants of London, it appears that there are 183 journeys taken each year by each inhabitant in all the public conveyances. He compares this with New York, "the only other city in the world with a fully developed system of internal railway communication." And incidentally he says: "There can be no doubt of the practical convenience of the lines of the Manhattan Elevated, and of the extraordinary technical ability with which it is managed." If the London underground system were used as much proportionately as the New York elevated roads it would carry 550 millions a year instead of 125. Counting internal means of communication alone, the reviewer finds that in New York there are 231 passenger journeys per head of population per annum as compared with 183 for all conveyances in London.

While no other town except New York can compare with London in its railroad communication, London in its tramway accommodations is far behind most of the other great towns of the world. It has but about 100 miles of tramway carrying 200 million passengers, while Berlin, with one-third of the population, has 180 miles which carry 121 millions; Boston, with one-fifth of the population, has 245 miles carrying 119 millions; Philadelphia, with one-quarter of the population, has 390 miles of tramways. The reviewer does not compare Chicago with London, as its metropolitan railroad is so recent and so short. While the cable system, "with its long trains of cars crowded with passengers wherever standing or clinging room is to be found, and driving slap-dash through the most important streets," is not to be considered by an Englishman.

The accommodations for London city passenger traffic being therefore inferior now to those of other great

cities and to those which are needed, are still less adequate for the future. The writer cites various instances of the growth of traffic as facilities are provided. As, for instance, in New York, where in 10 years the total movement by the elevated railroad increased 120 per cent. while the population increased but 45. He quotes Mr. Greathead to the effect that the traffic by internal conveyances of London, that is, excluding the great railroads, has increased out of all proportion to the population. For instance, in 1884 the passenger journeys were 18 per head of population; in 1874, 45; in 1884, 78; in 1889, 101, and "last year" (date not given), 114. At the rate of increase which has been sustained in recent years there will be 400 million more passengers to be carried in London seven years from now than are carried now if facilities are given. Of course all this is familiar doctrine to our readers, for these facts of the growth of passenger movement in much greater ratio than the growth of population have often been pointed out.

Admitting the inadequacy of London's accommodations for city travel, the question is, how are existing means to be supplemented? Obviously, not by occupying the streets. Considerations of speed and considerations of space both rule out at once any such suggestion. The new rapid transit lines, therefore, must be either overhead or underground; but according to the reviewer overhead lines like those of New York are out of the question in London, because for those who are passing below they are an "unmitigated nuisance, and had as they are in New York they would be ten-fold worse in London." Further, in the dark climate of London they would, at least in winter, for weeks together produce at midday the darkness of night. Finally to purchase right of way on useful and acceptable lines would cost too much. There is, however, one kind of elevated railroad possible in London; that is, by double decking existing railroads, and the reviewer thinks that before many years are gone this will be done in certain instances, that "ten years hence we may see the present rails given up to long distance or semi-suburban trains, and overhead an almost incessant service of electric trains for the accommodation of the truly suburban or omnibus traffic." But this is only possible to an existing company, and none of the London companies seem inclined to do it, while the present underground railroads—the Metropolitan and the District—are built on a system which is commercially impossible of extension. The chairmen of these companies do not hesitate to proclaim that their dividends do not come from the passengers who travel at penny fares over the crowded interior parts of the line, but from passengers whom they carry for considerable distances, and the reviewer goes on to demonstrate that while a shallow, underground line like the Metropolitan must cost now something like a million pounds per mile, no statistics of present traffic warrant anyone in supposing that interest could be earned on such an investment. His conclusion, then, is that nothing but the Greathead system, so called, is left, but he has the candor to tell us, what indeed must be well known to our readers, that in the last half year reported The City & South London was able to pay to its ordinary shareholders dividends at the rate of only half of one per cent. per annum. His opinion is, that this undertaking suffers from mistakes of engineering and mistakes of operation which are inseparable from an experimental enterprise. It is too small, it has too steep a gradient, there were early break downs of machinery, and the policy regarding fares has been experimental and fluctuating; but when all is said he thinks that the chance that this line will pay 5 per cent. interest is exceedingly small. In the three half years that it has been at work, working expenses have been respectively 79, 76 and 70 per cent. of the gross receipts.

Notwithstanding the somewhat unfavorable results of working the City & South London Railway six schemes were submitted in the last session of Parliament asking rights to build railroads on the Greathead plan, aggregating about twenty miles. The joint committee reported in favor of all these bills, but the dissolution of Parliament interrupted the proceedings and only one received the royal assent. The matter is therefore again open for discussion, but the argument of the Quarterly reviewer is not very favorable to the prospect of financing these projects or others like them even if they go through Parliament. The tendency of the Parliamentary committees and of the London City Council is to load the bills down with conditions that are very burdensome, and this coupled with the fact that they must compete with tramways and omnibuses carrying passengers at fares of one penny and even of half a penny, makes the outlook for any great extension of rapid transit facilities in London somewhat discouraging. Further than this, there is a tendency as shown in the Central London Act to impose an obligation to carry workmen the entire length of the lines (in that case six miles) for one penny, and the conclusion is that it will be difficult enough to make these lines pay under the most favorable circumstances, and "the prospects of the undertaking are by no means too bright. Capital for each new undertaking certainly will not be forthcoming if it is to be exposed to conditions of construction and working more onerous than the last one, still less if it is to be called on to carry a large proportion of its passengers at nominal fares, or to be threatened with the competition of rate-aided tramways."

Passenger Traffic at Chicago on Account of the Dedictory Services.

In our issue of last week we published statistics of the passenger movement to New York by various railroads during the Columbian celebration in that city, and we now report the volume of the passenger business at Chicago for the similar celebration there, as far as the figures can be obtained at this date. From the fact that a considerable part of the traffic originated from points some distance from Chicago, and that many roads have not yet received complete reports, these figures are necessarily largely estimated. It has been said in the daily papers that the railroads entering Chicago were disappointed at the small volume of excursion business for the dedication ceremonies, and also that the excursion rate of 1½ fare for the round trip which was adopted by all eastern roads and by the western roads for distances within 350 miles of Chicago had the effect of making the volume of excursion business much less than it would have been if a lower excursion rate had been made. The facts do not support this conclusion, however, as in the first place very little business other than the transportation of troops, state officials and invited guests came from points beyond the 350-mile limit, and, secondly, as it was generally understood that invitations were necessary to secure admittance to the World's Fair Grounds, many stayed at home who would otherwise have visited Chicago if everything had been thrown open to the public. As it was some of the railroads entering Chicago had an unexpected volume of business thrown upon them and all carried as many passengers as they conveniently could with the present facilities.

The following are figures, as far as they have been compiled:

The Chicago & Erie brought in during the four days, Oct. 18 to Oct. 21, inclusive, 10,113 excursionists, principally from points in Ohio. The numbers on the different days were divided about as follows: Oct. 18, 3,100; Oct. 19, 3,250; Oct. 20, 2,200; Oct. 21, 1,650.

The Michigan Central has no complete returns yet, and an approximate estimate is therefore made from the number of cars brought into the city. From this it appears that on the 19th about 7,200 passengers were brought into the city, and about 4,000 passengers on Oct. 20.

The Chicago, Burlington & Quincy brought in, approximately, 15,000 passengers during the four days in addition to its regular business and not including the troops transported.

The Atchison, Topeka & Santa Fé carried between 3,000 and 4,000 excursionists during the celebration.

The Louisville, New Albany & Chicago reports a total of 3,152 excursion tickets sold.

The Chicago & Northwestern records are not yet complete, but the Passenger Department estimates that the usual business was approximately doubled during the three excursion days and that about 35,000 people a day were brought into the city. This was principally suburban business and very little traffic originated at points beyond 300 miles from Chicago.

The Chicago & Northern Pacific carried 1,948 passengers to the World's Fair Grounds on Oct. 21, and brought the following numbers into Chicago: Oct. 19, 6,000; Oct. 20, 7,000; Oct. 21, 8,000; Oct. 22, 6,500. The number of passengers landed in Chicago a day by this road is said to be very nearly 6,000.

The Baltimore & Ohio carried about 3,550 passengers over the usual number carried, or a total of approximately 9,000 for the three days.

The Chicago, Milwaukee & St. Paul carried about 8,000 excursionists, of whom about 1,000 came from points outside of the 350-mile limit. The suburban business of this road amounted to about 15,000 passengers per day during the three days.

The Illinois Central carried 20,000 people an hour for six hours on Dedication Day, or a total of 120,000, between Chicago and the Fair Grounds. The number of suburban passengers ordinarily carried is from 25,000 to 30,000 a day. The excursionists on this road numbered about 4,500.

The North Side and West Side street railroad companies carried 1,640,000 passengers Oct. 20, 21 and 22, which is probably about their maximum carrying capacity.

The Canal Conference at Buffalo.

The late canal conference held at Buffalo was on the 100th anniversary of the first act passed by the legislature of New York to open a waterway between the Hudson and the Lakes. This route, by Lake Ontario, was superseded in 1825 by opening of the Erie Canal, which had both of its shores in the state of New York. One hundred years ago New York was the fifth in rank of the United States, but the Erie Canal immediately made the city of New York the great shipping port of the country, and consequently the greatest importing port; and receipts of grain by the canal are still an important direct and indirect factor in maintaining the commercial supremacy of that port. The total receipts of grain at New York for the seven years ending with 1891, were, as set forth in the call for the conference,

By canal	286,436,912 bushels
" rail (all routes)	305,944,722 "
River and coastwise	5,845,047 "
Total	600,547,511

or about 51.3 per cent. by canal, and it is held that the railroads of the state unaided by the canal could not maintain the port's position as being always able to offer a grain freight to departing vessels. In addition to this there is always a drop in freight rates on the opening of the canal.

The conference, which was presided over by Mr. George Clinton, a grandson of Gov. De Witt Clinton, was called to promote what is known as the Seymour plan of improving the canal; that is, lengthening most of the locks so as to admit the passage of two boats at once and increasing the present depth of the canal by two feet—from six to eight feet—this is to be done by adding to the height of the bank and excavating the bottom. The 530 delegates present were kept strictly to this programme, all attempts to pass resolutions in favor of a larger canal or to have the Legislature take cognizance of an alleged practice by the railroads of discriminating in the winter against a man who freighted on the canal during the summer were turned aside without delay.

The resolutions adopted were in favor of continuing the uncompleted work of bottoming out the canal and lengthening the locks by a proper appropriation; that any further plans should be left to a board of engineers to be selected by the executive committee of the Canal Union; that the same executive committee be empowered to bring the question of canal improvement before the next Constitutional Convention and that the Adirondack forest should be preserved as the watershed for the canals. Any attempt to confiscate the Albany basin was also denounced.

The proceedings closed with a mass meeting at which letters were read, and O. B. Potter, D. N. Lockwood, T. S. Alvord, J. M. Farquhar and L. Windmiller spoke. The last named gentleman, representing the New York Chamber of Commerce, referred to the ship canal scheme as follows: "A bill is now before Congress asking for \$100,000 for surveys and our Chamber has been requested to support it. This scheme would involve an expenditure of \$150,000,000 if it were practical, while \$300,000 expended by our own state on canals would accomplish the same object." This is putting a wastefulness of expenditures by a general government in rather a stronger light than is usual.

Hardening Circular Cutters.

Mr. G. F. Hinkins, of the St. Paul & Duluth shops at Gladstone, Minn., writes to *Sparks* as follows:

On the subject of hardening circular cutters of four or five inch diameters with knife cutting edge a few remarks may be in order.

These cutters try the patience of the toolsmith to an exasperating degree, while the losses from cracking and from pieces breaking out of the cutting edge are a serious item of expense. If, therefore, I am not trespassing upon ground already covered, I will offer a suggestion or two, based upon experience, which may not only aid in obviating mishaps with this kind of cutter, but also with other kinds of tools of unequal bulk or of uneven shape, which would cool quicker in one part than in another. One mode of treating these cutters so as to equalize their bulk as much as possible is to drill holes in the thick parts, and this is a good way; but to determine just where and how many and how large the holes should be to equally proportion the cubical contents requires a degree of judgment and mathematical ability beyond the limit of most tool-smiths, nor can the smith always have at hand a mechanical expert to consult, and if he could, it is by no means certain that the latter would be correct in his estimation of what ought to be abstracted to equalize the cooling process. I therefore take recourse to the rule of finger and thumb, good horse sense experience, as follows: I heat the edge of the cutter to the hardening heat, a heat which I find to be surprisingly low on account of the reduced area and the slow conduction of heat away from the edge through the particles toward the centre of the piece. The next important thing to overcome is tension, which can be done by distributing proportionately the heat of the part that is required to be hard over all of the portion that does not need to be hard. The object of this is to lessen the risk of cracking in hardening by having the steel cool together throughout so as to render the cooling simultaneous. To do this requires patience, care and good judgment. I place the cutter on a long mandrel and rapidly revolve it in a brisk fire, in order that the edge may be brought to a hardening heat before the body gets hot, and if the edge appears to be getting too hot, I extract or diminish the heat by means of the drip or by the application of wet waste, and in this manner I bring the steel back and forth until I get it in the right mood (and if it is not in the right humor, like people, it may snap). I then dip in the usual way and as a general thing my cutter is sound. Comments are in order.

The editor of *Sparks* adds that it seems to him that this method of imparting heat, by conduction from the circumference of a cutter with its exposed edges, is fraught with danger, unless great patience, care and good judgment are exercised to prevent the edges from getting too hot. The rapid rotary motion given to the cutter is probably the secret of Mr. Hinkins's success.

A New Sanding Device.

A new track sanding apparatus has just been invented by Mr. C. W. Sherburne, of Sherburne & Co., dealers in railroad supplies, of Boston. The device is simple and effective, and is used automatically in connection with the air brake. The sand is dropped on the rails when the engineer moves his brake valve to make a stop, consequently no attention is required from the engineer. It has been carefully tested in actual service with satisfactory results. The device will be illustrated and described in detail in a future issue of the *Railroad Gazette*.



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EDITORIAL ANNOUNCEMENTS.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notices of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

During a recent discussion on a paper on Signals read before the American Society of Civil Engineers, one of the speakers said that for many of the roads in this country the adoption of the standards of safety enforced by the English Board of Trade "would spell bankruptcy." The adoption of the block system, efficient distant signals and interlocking is certainly costly especially on crowded lines and at complicated junctions where numerous levers are required, but to a large extent the expense is proportional to the volume of traffic and need not be excessive on lines with a thin traffic. That the extended use of efficient signals does not necessarily mean pecuniary loss is shown by the Annual Report of the New South Wales Railways, just received, in which the following large increase in the appliances indorsed by the British Board of Trade has been attended by an improvement in the percentage of net profits on the capital expended.

	Miles open.	Miles worked under absolute block.			Percentage of places interlocked.	
		Four and double track.	Single.	Total.	Inter-locked.	Not inter-locked.
Oct., 1888	2,114	28	...	58	24.67	75.36
Aug., 1892	2,206	149	905	734	51.40	48.60

The absolute block system on single track roads is secured by means of Tyer's tablet, or Webb and Thompson's electric staff, and it is stated that at the close of this year 956 miles will be worked under this system. The traffic on the whole system is thin, the average number of trains each way per day being 5.8 and the earnings per annum per mile open being \$6,972. Deducting, however, 835 miles of new and branch road which is stated to be unprofitable at present, having been built to develop the country, the traffic on the remaining portion on which the block system and interlocking is adopted is \$9,849 per mile per annum with 7.58 trains each way per day.

There is one railroad in the United States which is worked under the block system throughout, and it is not a small one either. It is the Chicago, Milwaukee & St. Paul, with 6,100 miles of road. As our readers know from previous statements in these columns, this road has kept trains a station apart on some parts of the line for several years, the station operators communicating with each other by short circuits, extending through three stations, and the Morse telegraph being used.* This system has been extended over all the busiest portions of the road; and on all other parts the train dispatchers have orders to see that no train, passenger or freight, leaves a telegraph station until the last preceding train has reached the next telegraph station, the orders being given to the station operators in the usual way. Some of the lines of the Milwaukee have very few trains and on these the dispatchers can do this blocking very easily, in the manner used on the Canada division of the Michigan Central; that is, a train leaving a station a long time after the last preceding one can be moved under an order giving to it a clear track for several stations in advance.

* See Railroad Gazette, April 30, page 300.

Thus the number of orders issued is not excessive. It must not be assumed that because the Milwaukee mileage is very long, it is all very "thin." The company does a large business on some of its lines, and it has over 100 miles of double track. Those portions of the road where business is heaviest are more than usually well adapted to the service, stations being frequent, and sidings or second main track being sufficient; and permissive blocking is, we are assured by the officers, a very exceptional thing. So far as we now recall, this is the only road using the space-intervals so completely. The West Shore is blocked its whole length, but the system cannot be said to be used on the whole road, as there has lately been added a branch, Syracuse to Earlville, which, we believe, is not blocked. The space interval system is now increasingly appreciated in all sections of the country, and we may hope to see it adopted with considerable rapidity. The Chesapeake & Ohio, which has blocked passenger trains for several years, now blocks all trains on about 120 miles of its road, a number of towers and improved signals for this purpose having been erected on the Huntington Division. The Richmond & Danville blocks about 80 miles on the Virginia Midland Division, a number of new towers having been established. Among the other roads not mentioned in our list published Feb. 5 last is the Norfolk & Western, 246 miles blocked. The Erie and the Baltimore & Ohio have extended their block systems since that date. One of the most encouraging features of this progress is the fact that superintendents can have better and better opportunities of seeing, from actual practice, that the usual rule of sending out all freight trains as soon as they are ready can be safely changed to one distributing them more evenly over the 24 hours of the day, thus permitting the use of long space intervals. The belief that this cannot be done without causing intolerable disturbance of the traffic has been the cause of much hesitancy in this matter.

The Long and Short Haul Controversy.

The last decision on this question from the new United States Circuit Court of Appeals, sitting at St. Paul, will, if it is sustained, add to the doubt previously entertained in some quarters over the proper construction of the long and short haul clause (Sec. 4) of the Interstate Commerce Act. Judge Brewer, of the Supreme Court, sitting in the Circuit Court of Appeals, delivered the opinion of the Court, and anything coming from him is associated with the high authority of the Court of which he is a member. This impression, in favor of the correctness of his ruling is, however, weakened by the fact that Judge Cooley, one of the foremost jurists of the land, arrived at an opposite conclusion. An examination of Judge Brewer's decision does not carry that conviction of its soundness that one likes to feel on reading the opinion of a justice of the Supreme Court of the United States, and we cannot believe that railroad officers will hasten, as the Chicago correspondents are intimating, to make tariffs based on the Judge's view. It is too likely to be overruled.

In another column may be seen as full a summary of the case under view as has yet been published. Judge Brewer seems to have held that where two or more connecting roads unite in a joint tariff for a continuous haul such tariff may be fixed at any figure the roads may agree upon, without reference to local rates of either company, and that so long as the local tariff is reasonable, the joint tariff for a longer distance in the same direction may be much less if the carriers so agree. Or, to use the language of the decision, "Neither company is bound to adjust its own local tariff to suit the other; nor compellable to use a joint tariff with it. It may insist upon charging its local rates for all transportation over its line. If they make a joint tariff it is not a basis by which the reasonableness of the local tariff of either line is determined."

In this particular instance the Chicago & Northwestern received under its local tariff 18 cents per 100 lbs. for the distance between Scranton, Ia., and Chicago, and under the joint tariff, through freight for New York, from Blair, Neb., to Turner, 30 miles west of Chicago, a much greater distance over the same line, in the same direction, about 11 cents per 100 lbs. This was charging greater compensation for the shorter than for the longer haul under what are claimed to be substantially similar circumstances and conditions, which is forbidden by the Interstate Commerce Act. No fair reason is shown why New York freight should be billed to Turner, but that is a minor point. As to this particular grievance, amounting to \$200 or \$300, the decision may possibly be just; the interest centres on the construction put upon the phraseology of the law.

In July, 1887, among the earliest cases decided by

the Commission, that tribunal held, on the complaint of the Vermont State Grange against the Boston & Lowell, that if several roads join in making the tariff which constitutes the lesser charge on the longer haul, while one or more of their number make the greater charge on the shorter haul, the case is within the statute, and those who make the greater charge must justify it. In that case the carriers contended that their joint tariff did not constitute the common control, management or arrangement, referred to in the law, and accordingly they were not within the law. But the Commission held otherwise. In its opinion, delivered by Judge Cooley, it is said: "Any common carrier" is as much restrained when it unites with one or more others in making the long haul charge as when it makes such charge independently." We are not aware of any case where the Commission has held otherwise or where the position has been substantially modified. For more than five years this has been uniformly the current of the Commission's rulings, pronounced in opinions by its ablest members, and these rulings have been quite generally acquiesced in and joint tariffs so constructed as to conform thereto.

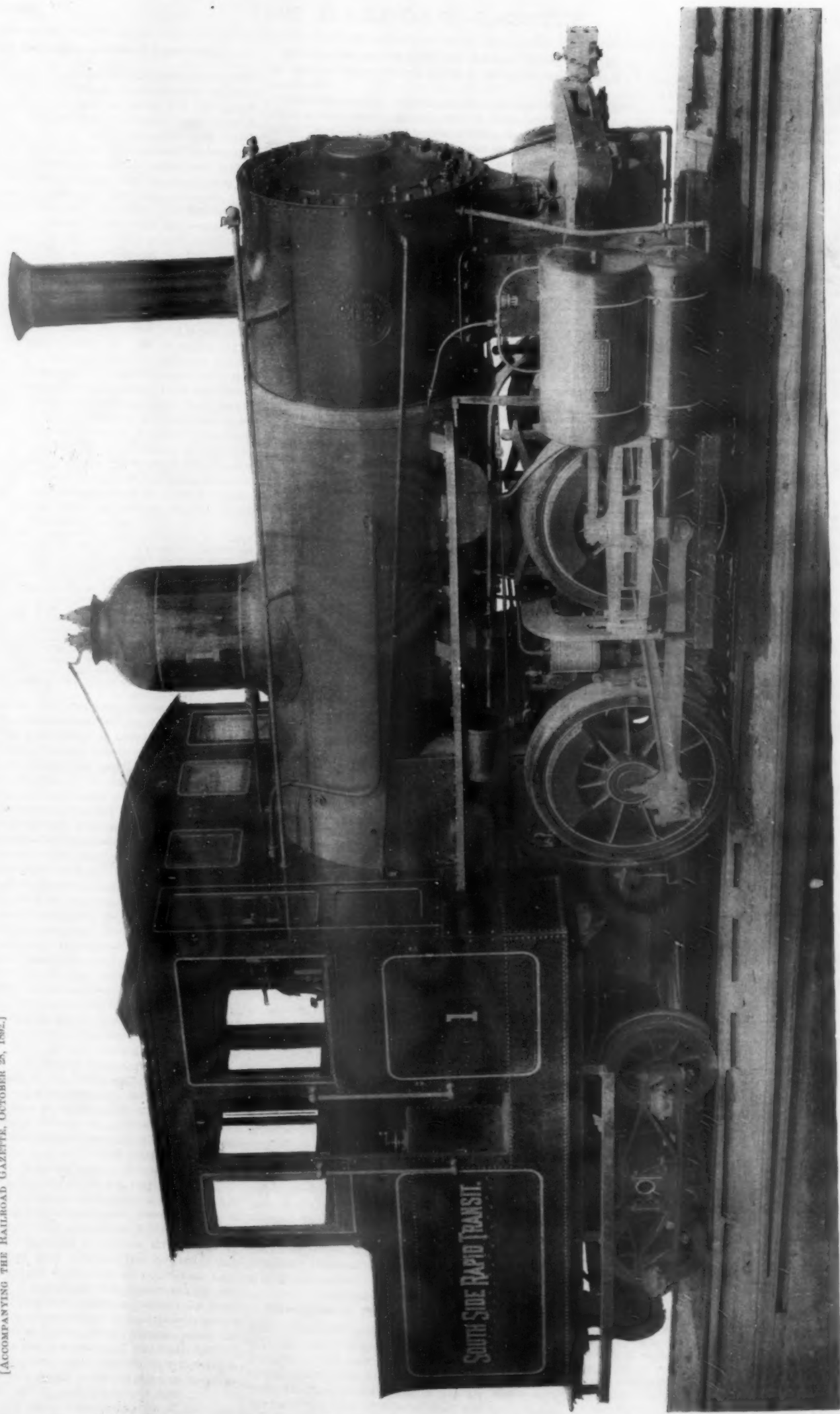
In the Chicago & Northwestern case the Court below evidently coincided with the views of the Commission and rendered judgment accordingly. We cannot say how many other Courts of first resort have rendered similar judgments, but it is fair to presume that the current of the decisions by the Courts has quite invariably on this point set in with those of the Commission. We are now confronted with a divergence, and it becomes interesting and important to know, in the language of the distinguished Congressman from Alabama, "Where are we at?" Judge Brewer holds, substantially, that the conclusion reached by the Commission in the Boston & Lowell case and frequently recognized and enforced by it afterward, is erroneous and contrary to law. In view of this difference of opinion among authorities of such high standing, even a wayfaring man is somewhat justified in looking at the law for himself and reading it as he runs.

For many years back the public had been complaining of the injustice of making the local charges on short hauls stand alleged losses from the low tariff on the long, through hauls. From general public complaint and criticism the matter passed into legislative halls and constitutional conventions, and in time the laws of more than half of the States of the Union contained provisions, more or less similar to Section 4 of the National law, forbidding the greater charge for the lesser haul. But the limited jurisdiction of the separate States prevented complete redress, and the Interstate Commerce Act was the slow outgrowth of the constitutional limitations upon the power of the State to deal adequately with the matter. The question is not whether the present Act is itself complete or its passage in all respects desirable. Whether the situation required any legislation at all by Congress, or this legislation in particular, is not material in this controversy. Nor is the constitutionality of the Act in question. The plain inquiry is: What does the fourth section of the Act mean?

If it is assumed that the evil to be corrected was the imposition by common carriers upon the traveler or shipper for a short distance, of charges that ought, in justice, to be borne by the long distance traveler or shipper over the same line in the same direction, we ought to conclude that Congress meant by its language to forbid and discontinue the abuse effectually and finally. If we accept Judge Brewer's interpretation, a carrier owning a through line from A to C would be controlled by the law. But two connecting carriers owning respectively the lines from A to B and from B to C, entering into a joint tariff, would not be so controlled. In both instances the evil exists. In one case it can be corrected, in the other it cannot, under the Act.

Surely, if we are entitled to the equal protection of the law, we should be subject to its equal prohibition and punishment. The construction of Judge Brewer seems to authorize a partial and unjust application of the law in one case and a total exemption from it in another, when in both cases the same grievance exists. The interpretation of Judge Cooley, on the other hand, brings all the carriers, whether owning through lines or having merely joint tariffs and through connections, to the same level and deals out even justice to all. It may be broad and liberal, but it is adequate and equal, and to the common mind has the merit of carrying out the spirit of the law, without partiality or oppression. The full text of Judge Brewer's decision may possibly modify the points published, but from present information he seems to have juggled with the word "line" until he came to overlook the uniform trend of the discussions on this subject for the last twenty years,

[ACCOMPANYING THE RAILROAD GAZETTE, OCTOBER 25, 1892.]



COMPOUND LOCOMOTIVE FOR THE CHICAGO & SOUTH SIDE RAPID TRANSIT RAILROAD.

Designed by D. L. BARNES, Consulting Engineer.

Built by the BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa.



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New Hamburg and West Cambridge.

The official reports of the State Railroad Commissioners have now been published concerning two of the recent serious train accidents, those at New Hamburg, N. Y., Sept. 1, and at West Cambridge, Mass., Sept. 10, and they deserve notice for two special reasons, besides others of lesser consequence. The telegraphic summary of the first-mentioned case says, in substance, that the bridge tender was to blame and the engineman was not; that the signals were not properly displayed. This contradicts the statement of the officers of the road that the signals were properly interlocked and tends to discredit the signal system, for with proper interlocking it is impossible for a draw-tender to fail in this way. The West Cambridge report gives the first clear account of the automatic signal arrangements there and shows the engineman's recklessness in its true light. Let us first consider the New Hamburg case.

The home signal is on the bridge and is not interlocked. The distant signal is 1,650 ft. south. About 1,500 to 1,700 ft. further south (the distances are not stated with precision) is the starting signal of a new block signal tower. This tower, which has a home and a distant signal, as well as a starting signal, is at the end of a third track, where formerly a switchman, on the ground, was accustomed to show a danger (or caution) signal whenever he saw the distant signal of the draw-bridge at caution. This new block tower had recently been put in service and was the northernmost of the new towers in use. The train, approaching from the south, found the distant, home and starting signals off (all clear) and the Commissioners find:

From the well-known record and habits of Peter Owens, the engineer of No. 21, as a careful, intelligent and faithful employé in the discharge of every duty incident to his calling, the peer of any among a corps of employes second to none on this continent, it is believed that on this morning when he approached the distant signal set at safety, the home signal set at safety, and the advance signal set at safety, that he expected—and he had a right to expect—a clear track; that in this confidence as to his absolute right under a system of signaling in use for twenty years, he stepped to the left side of the engine, after passing the advance signal, to enable him to get a better view of the bridge by looking across the curve, and that while in this position for a moment the semaphore [distant bridge signal] was passed.

The testimony was taken by Commissioner Rickard, formerly an engine runner, but the report is "By the Board." The draw tender is censured, and properly, for not getting competent assistance according to custom (the draw is moved by hand), and also for opening the draw too close to the time of the train, which very likely is just, as the rule was a proper one. But in holding him at fault for not waiting before opening the draw until the new tower-man should also put his signals at danger the report has the air of attempting to bolster up a defective signaling system. This tower-man is also blamed for not putting his signals at danger when he saw the distant bridge signal "on," but there is no evidence that he was required by rule to do this, and if he was thus required, the rule was at variance with all the best practice. The signal worked from the tower was for the purpose of letting trains go to the bridge whenever the road was known to be clear (or, under the time interval system, whenever the last preceding train had been gone the prescribed number of minutes). The engineman, if he assumed anything by the tower signals, assumed that they indicated that the bridge signal would be at the "all-clear" position. He is now dead, but we cannot believe that he intentionally did this, to the extent of deciding that he need not look at the bridge signal. His failure to observe the latter was, doubtless, due to pure forgetfulness. We have no desire to detract from the honor due to "a peer of the best employes on the continent," but the use of fine phrases does not cover up the fact that a plain and well understood warning signal was shown 1,650 ft. from the bridge. We see no mention of fog or smoke and the curve was very slight.

The railroad company maintained a defective system in placing dependence upon the exhibition of danger signals by the switchman 3,000 or 4,000 ft. from the bridge, who had to get his information by word of mouth or other uncertain method, and it may be censurable for not seeing that the engineman fully understood the change to the new signals and the abolition of the old custom of warning runners by hand motions, but the Commissioners give us no information about that; and no fair-minded engineman would for a moment claim that a warning, of any kind, 3,000 ft. from the danger point, warranted him in neglecting to look with the utmost care at the regular and most important signal 1,650 ft. from the danger point.

The only important recommendation of the Commissioners is the following:

The amount of business passing through this draw is very small, being practically confined to one boat carrying a few passengers. The bridge should be raised high enough to allow a canal boat loaded with coal to pass under, and be made permanent, without a draw.

This is much to be desired, but reforms infringing the ancient rights of navigators are extremely hard to carry out.

The Massachusetts commissioners, like those of New York, give too much prominence to secondary questions. It is well enough to discuss rules about opening draws at the proper time, but the vital point on a great railroad is to make it safe for a train to approach a draw at any time. At West Cambridge the passenger train would not have been run into if there had been a double track on the branch that it was about to enter; but that train might be stopped in the same place by any one of a hundred causes, and the essential lesson to be learned is, how to make it safe for a train to stop anywhere at any time. This proves to be, in this case, as we intimated at the time, wholly a matter of discipline. The Commissioners very justly lay the whole blame upon the engineman of the freight, Goodwin. The conductor was probably jointly responsible for the high speed, as there was considerable fog, and the rule required the point of collision, a junction, to be approached at only eight miles an hour; but the engineman's recklessness appears to have been of a particularly flagrant character. Automatic-track-circuit block signals are in use for three miles before reaching the point where the collision occurred, and they appear to have been in good order. A few hundred feet back of the passenger train was the distant signal (mechanical semaphore) for the junction, and this Goodwin appears to have not even looked for. He blew two blasts of the whistle for something or other, but gives no rational explanation of the act. His claim that he was answering the junction home signal, far ahead, is absurd. The brakeman is justified by the Commissioners for having taken the two blasts as an answer to his lantern signal. The brakeman did not use torpedoes because he had not gone the prescribed distance. He could have fortified his own position on the trail if he had put them down anywhere, and to always go the whole distance is often to obey the letter while disobeying the spirit of the rule; but as no one can expect to uniformly enforce such a difficult rule as this, it is not worth much discussion here.

Such conduct as Goodwin's affords strong presumptive evidence of careless habits; it cannot be exceptional, and it lays upon a public body like the Commission the duty of investigating the general state of discipline on any road where it appears. It is incredible that a man behaving in this way should have a clean record in the past if he has been properly watched, and the company is, therefore, bound to explain its methods of watching its men. We are not unmindful of the fact that the Massachusetts Commission is the most intelligent and careful body of the kind in the country; nor do we forget that, generally speaking, employes of Eastern roads are more likely to be found sober, conservative and reliable than those on roads where "floaters" are more common, but this should only sharpen the criticism in a case like this. A road with plenty of good men to choose from has the least excuse for employing those of doubtful qualifications. The best railroad commission in the land should be guided by the highest and strictest standards, and thereby exert an elevating influence on other commissions.

Some points in the testimony deserve a passing notice. An engineman stated that a white light on a crossing gate sometimes appeared in line with a certain signal; this shows the need of a colored all-clear signal. The passenger engineman called in his rear brakeman just at the time when the latter had met the freight; that is, before he had time to go far enough to put down torpedoes, according to the rule. This is what is done at many places every day, but in how many of these cases does the man persist in fully carrying out rule 99 before returning? Probably very few. Superintendents who depend upon that rule for safety are bound to recognize this weakness. The fireman of the freight testified that he did not know the location of the signals and did not look for them; and yet the Fitchburg is one of those roads where enginemen must show their telegraphic orders to the fireman. This man's intelligence would seem to need a little cultivation.

Instructions to the Man Who Does the Work.

As a railroad system increases its mileage and its business covers a larger territory, the more complex the organization becomes. While a line remains small in extent, not covering more than two or three hundred miles, the Superintendent has to give his orders to a comparatively small number of men who are in direct touch with the individual employes in the various departments. On a large system, however, general orders have to pass through a large number of officers before acting upon the individuals whose efforts affect directly the operations of the road.

In order that each foreman should be able to do his work understandingly he must be sufficiently informed as to the general instructions given in the various branches of the service as far as they refer to his particular line of work. It seems as if money were often lost to the company from the fact that the lower officials, such as shop and road foremen, or yard and train masters, were not properly informed on orders issued referring to their departments of work. The orders issued by the General Manager in regard to any branch of the service go through the General Superintendent to the Division Superintendents, Master Mechanics and Roadmasters. These officers are apt, in many cases, to think that it is not necessary to pass those orders forward to the different foremen, or those in direct charge of the work, as they intend personally to see that the general orders are carried out. This action is no doubt often due to a theory that responsibility must not be subdivided, or shifted from man to man down through the grades; but it is perhaps sometimes from a fear that the subordinate officers will become too well posted as to the policy and requirements of the company; and the lower down in the scale the official is, the more frequently do we find that he has this distrust or fear of his subordinates. The consequence is that the men in immediate touch with the individual who labors and uses up material, are not sufficiently informed to carry out in the best manner the aims of the management.

We might multiply examples, but a single instance will illustrate the point. At one time, upon a certain road, an order was given that in order to reduce the stock of materials carried, and to save making purchases, any material on hand should be used when possible, even if not exactly what might have been used under ordinary circumstances. The order seemed to have reached the Superintendents and Master Mechanics, but the foremen were found in many cases to be ordering new material when there were articles on hand which could have been readily used. It was found upon inquiry that no systematic effort had been made by the Master Mechanics to see that everyone understood the character of the general order. The Master Mechanics undoubtedly reasoned that they would be able to give personal attention to the matter, but the fact was that they could not attend to every detail that arose. Similar cases arise in the matter of collecting scrap material, policing the road, making up trains, handling terminal work, and many other ways. In fact, too much care cannot be taken that everyone concerned in carrying out a certain order should know perfectly the scope of that order if they do not know its language.

As said at the commencement, this feature seems to be lost sight of sometimes, and it is probably worth the attention of every Manager to see that arrangements are made so that every foreman, no matter how few men he has under him, shall be fully posted as to the significance of any order which he is expected to personally aid in carrying out. To do this it will be necessary to make a very thorough job, for the old feeling that understrappers should not be taken into confidence persistently lingers in the breasts of many otherwise good officers. This is often based on jealousy—perhaps unconscious—and we all know that jealousy is not to be eradicated by a mere circular. Again, division officers must be cautioned not to withhold details from foremen too much on account of the (comparative) lack of judgment of the foreman. As we have pointed out, it often happens that his judgment, whether good or poor, is the one which actually governs a given transaction; and as long as this is so the true principle is to train his judgment by exercising it.

Transportation in Chicago During the Dedication Exercises.

The dedication of the World's Fair buildings is over, and the managers of the Exposition, the transportation companies and the people of Chicago are to be especially congratulated upon the fact that the vast crowd was carried to and from Jackson Park without a serious accident.

In the *Railroad Gazette* of Oct. 7, a statement was made showing the uncertainty of the capacity of the proposed transportation facilities to and from the grounds, and the results of the past few days have shown that they are by no means adequate to handle the traffic estimated on a reasonable basis of daily attendance next year. The deficiency is now fully appreciated by the railroad companies interested, and great efforts will be made to provide the necessary equipment and to insure the safe handling of passengers. At present the Illinois Central tracks are in a transition stage, partly elevated and incomplete, and partly on the old level; the southern terminus of the elevated road is over a mile from the nearest entrance gate to the fair grounds; the cable lines are from half a mile to a mile away, but reach the grounds by two horse car lines; and the docks for

the boat lines are separated from the grounds by the nine or 10 yard tracks of the Illinois Central. The Illinois Central tracks are totally unprovided with fences and gates at the stations excepting one temporary structure at Van Buren street.

Under these very adverse circumstances not less than 150,000 people were carried to and from Jackson Park, and a very large number were carried shorter distances and in opposite directions to reach the line of the parade. Thirteen persons were injured, none fatally. The results would have been much more serious but for the vigilance and care of the railroad employes and police and the expertness of Chicagoans in looking out for themselves. The crowd which visited Jackson Park on Friday was essentially a Chicago crowd, and was therefore in the habit of running in front of locomotives and grip cars, dodging wagon poles and otherwise taking great risks at every opportunity.

The people foresaw that there would be a crush and therefore many started early. By 8:30 a. m. the trains were crowded and at 9 o'clock suburban trains on the Illinois Central coming into the city were taken possession of by the crowd as soon as they slacked up near the Lake street terminus, on the assumption that they must soon start back. The same tactics were adopted at Fifty-seventh, Sixtieth and Sixty-third streets and on the cable lines by people desiring to return to the city. People filled up trains going south and paid an extra fare to secure seats for the return trip.

The Illinois Central used two tracks for its regular suburban business and two for special express trains between Van Buren and Fifty-seventh streets which were run at five-minute intervals. Some freight trains were run on the two tracks that have been raised. On the "Alley" elevated road five-car trains were run at intervals of four minutes, and not a single passenger of the 113,000 carried was injured. The cable lines ran trains as closely together as possible. In all cases, southbound trains during the morning were jammed full before leaving the northern terminus, so that entering the trains at intermediate points was a physical impossibility, while by 2 p. m., before the procession had fully entered the fair grounds northbound trains were well-filled by home seeking visitors. After the close of the exercises the morning crush was repeated, with this difference, that empty trains on the Illinois Central could not be hauled out rapidly enough at the northern terminus, so that the incoming line was blocked with trains as far as Twenty-second street, and large numbers got off there, and walked the remainder of the way.

The transportation of the multitude was very far from being a success. The capacity for handling passengers was not equal to the demand and no one who has examined the problem at all had any idea that it was, as none of the improvements which are in hand, and which it is reported will be completed by the time the Fair opens, were sufficiently advanced to be of any assistance.

The day's work furnishes a good object-lesson, however, which will doubtless be of great service to the railroad managers who are directly interested in the problem, in showing them more clearly some of the weak points of the present system, or lack of system. With thousands of people rushing for trains before they had stopped; no fences or protection other than the efforts of employes and police at Randolph street and other stations; no bridge over the tracks at the Van Buren street docks; stations on the wrong side of the tracks; grade crossings at Fifty-seventh, Sixtieth and Sixty-third streets, and with men riding on the tops of the cars and on the pilots of the engines, the transportation of at least 150,000 passengers without fatal accident shows how many chances human beings can take and not get killed.

Washington Excursion Business Over the Pennsylvania.

We gave last week a brief statement of the estimated volume of the passenger business to and from Washington on the occasion of the National Encampment of the Grand Army of the Republic in that city Sept. 19, together with some discussion of the matter. We have since received a somewhat more detailed estimate made by the officers of the Pennsylvania road, together with some account of the extra facilities that were prepared for handling traffic. It will be borne in mind that all the passengers from the west over the Pennsylvania road proper, together with those from the New York division, and all north and east of New York, were concentrated at Baltimore, the whole traffic being carried over the Baltimore & Potomac, thence to Washington, 45 miles. The Pennsylvania also handled all the business by rail from the south; the Richmond & Danville, the Atlantic Coast Line and the Chesapeake & Ohio all coming in over this company's track. The Chesapeake & Ohio alone brought in 17 trains on one day. Many of these passengers came from the far west. On Monday, Sept. 19, 131 trains were run into Washington from the north. For the week ending Sept. 24, 4,500 passenger cars were received from both north and south. The number of passengers in these was 118,000. For the five days closing with the 19th, over 100,000 passengers were received.

As far back as last June the division superintendent consulted the principal shippers at Washington, and they heartily co-operated in preparing for a week's suspension of freight business; and the records of July and

August showed the heaviest freight shipments ever known on the Maryland division. The division officers held a consultation in August, and a circular was sent out to all employes, and on Sept. 17 all the freight yards at Washington were cleared for passenger traffic. By permission of the District Commissioners the widest street adjoining the passenger station at Sixth street was fenced off and four tracks temporarily laid upon it. These were supplemented by platforms, properly lighted, and used for inward trains. Two and a half miles of platform, altogether, was built in Washington. The sleeping cars, 116 of them (used as lodgings), were stored in the freight yards, which were provided with plank sidewalks, electric lights and pipes for supplying fresh water. The sanitary arrangements were carefully planned and uniformed employes were assigned to the care of the yard. The large freight house at Sixth street and Virginia avenue was used for all inward baggage from the northwest, and that at Ninth street and Maryland avenue for baggage from the northeast. The passenger cars of each arriving passenger train were at once taken back to Philadelphia, and the baggage cars were then taken to these freight houses. Outgoing baggage was handled at the main passenger station. Two temporary passenger stations were established for local passengers, one at Ninth street for the Southern lines, and one at Sixth street and Virginia avenue for trains to and from Baltimore.

All available employes on the divisions south of Philadelphia were instructed to be constantly ready for duty, allowance only being made for the minimum time for sleep. Sleeping and meal accommodations were provided on the railroad premises for train employes. Extra engines were located at a half dozen places between Washington and Philadelphia. The freight crews had been run through a few times between Philadelphia and Washington to familiarize them with the road. All extra trains took coal at Bay View. Between Baltimore and Philadelphia freight was moved whenever the freight men were not needed for passenger trains, but from Baltimore to Washington nothing but perishable freight was moved during the rush. There was no serious mishap except that one freight train got off the track and blocked the road for two and a half hours during the homeward movement after the encampment.

The Autumn pressure is now being felt by the freight departments of practically all the roads of the country. General freight has been heavy for several weeks, and a very large and steady movement of grain, much of it last year's corn, has served to augment this. The weather in the west has been uninterruptedly favorable for shipping, and within a week scarcity of cars has been reported from all quarters. Elevators are full at Chicago and at Lake Erie ports, and the roads west of Chicago cannot get their cars unloaded. At Buffalo the grain men are paying the canal boats 5½ cents a bushel for wheat to New York, about double what the railroads took it for three or four months ago. The coal roads of Pennsylvania are crowded, largely because they have taken out from the mines more coal than can be sold. The wide extent of territory over which the scarcity of box cars is felt, serves to confirm the view that many companies have failed to build new cars as fast as their business demands. It is true that cars now built are of much larger capacity than those of former years, but capacity does not always make up for numbers. For local business and for miscellaneous shipments composing a considerable share of the total movement the need is for cars; and a 20-ton car is no better than one carrying ten tons. The additional capacity is often useless, for the strong cars cannot be confined to the heavy goods. Statistics of most of the present heavy movement are hard to get, but an indication of the state of affairs on the western roads can be found in the fact that for the first half of this month the quantity of grain brought into Chicago by the ten principal roads was nearly 2½ times as large as a year ago:

	Receipts —thousands of bushels—	
	1891.	1892.
Atchison, Topeka & Santa Fe.....	500	414
Chicago & Alton.....	966	232
Chicago, Burlington & Quincy.....	5,558	1,716
Chicago, Milwaukee & St. Paul.....	1,350	1,382
Chicago & Northwestern.....	3,048	1,044
Chicago & Eastern Illinois.....	628	98
Chicago, St. Paul & Kan. City.....	920	378
Chicago, Rock Island & Pacific.....	2,329	1,158
Illinois Central.....	2,167	726
Wabash.....	722	132
	19,207	7,778

The latest Reading sensation is the announcement that an "agreement" has been made with the Boston & Maine. The terms of the agreement, or alliance, have not been published, but Mr. McLeod becomes President of the Boston & Maine and President Jones, of the Boston & Maine, becomes Chairman of the Board, a new office. It is said that he retains executive charge of his road. The Boston & Maine system comprises 319 miles owned and 894 leased, a total of 1,213 miles. So recently as 1890 it was formed by the consolidation of the Boston & Maine, the Eastern and the Portsmouth, Great Falls & Conway. Of the leased lines the most important are the Boston & Lowell, 99 miles, leased in 1887 for 99 years; the Central Massachusetts, 99 miles, leased through the Boston & Lowell; the Connecticut & Passumpsic Rivers, 147 miles, leased through the Boston & Lowell; the Wer-

cester, Nashua & Rochester, 94 miles, and the Northern (New Hampshire) system, 173 miles. Besides those there are about 20 small roads, leased at various times. The whole system covers New England north of the latitude of Boston to Portland, and west to the Connecticut River, reaching the principal Northern New England ports by its own lines or through the Maine Central, connecting with the latter road at Portland, with the Grand Trunk and the Quebec Central at Sherbrook, the Canadian Pacific at Swanton and the Central Vermont at White River Junction. The Boston & Maine has been a good dividend payer for years. From 1881 to 1885 it paid 8 per cent. on the common stock; in 1886, 9½ per cent.; 1887, 10 per cent.; 1888 and 1889, 9 per cent.; 1890, 9½ per cent. and 1891, 9 per cent. In May last 4 per cent. was paid. The new arrangement may give some importance to the Poughkeepsie Bridge route between the coal fields and New England points. It may help the Philadelphia, Reading & New England to earn its fixed charges, and it may ultimately realize some of the dreams of the builders of the bridge; but as far as present prospects are concerned it is difficult to see where any marked benefits will accrue, except such as are naturally incident to an alliance of large interests in the money market. The two systems already interchange all the traffic they can get to interchange, and have been doing it for a year or two, but without any marked influence on earnings. Their connection through Northampton is dependent upon the New York, New Haven & Hartford for a 30-mile link, and the entire line, from the Delaware River to within 50 miles of Boston, is burdened with heavy grades and has meagre facilities. The Reading cannot do great things in carrying coal to New England unless it can deliver it to the large towns of eastern Massachusetts, but these are all within 40 miles of tidewater, where coal is cheap. The assertion that the control of the New York & New England has also been acquired is not made with an air of confidence, and needs confirmation. But that road affords a route to Boston but little better than the Central Massachusetts, and the New England road as a whole is as likely to prove a burden as a benefit to its purchasers. Its prosperity depends practically on local business, which must be very carefully nursed through a rather slow period of growth.

It is generally known that the St. Clair tunnel under the St. Clair River between Port Huron, Mich., and Sarnia, Ont., has now been open for freight traffic since October, 1891, and for passenger traffic since Dec. 7 of the same year. This tunnel was described in the *Railroad Gazette* of Sept. 23, 1890, and the decapod tank locomotives which are used in operating it were illustrated in our issue of April 3, 1891. These locomotives were used at first without tenders, but as the water capacity of the tanks, 1,800 gallons, was found to be insufficient for convenience in operating, tenders have been attached to three of the four engines which are in use. The engines were originally fitted with fire brick arches and coke was used for fuel, but, as there was a deficiency in steam making power with coke, anthracite coal has been substituted. The brick arches have been removed. Three of the engines are in daily service, the fourth being in reserve to allow for repairs, etc. The maximum train which is handled by them is 27 loaded cars. The tunnel is single track, but the approaches are double track. The operation of the tunnel is in the hands of a train dispatcher at the Sarnia end and a train order is issued to each train going through the tunnel. No freight trains are run through without a caboose attached, thus making a complete train service at all times. The tunnel clears itself of gas rapidly, and in running with the tender in front it is possible to see a reasonable distance ahead from the cab, but when the engine is running head first the cloud of steam is such that seeing any distance ahead is impossible. Also when running in the latter direction the gas which penetrates the cab in spite of closing windows and doors is anything but pleasant. There are lights placed near the middle of the tunnel, but it cannot be said that the tunnel is lighted. However, on account of the interlocking signals and the system of operation there is no danger from collision, and the time during which a train is in the tunnel, about 2½ minutes, is too short to inconvenience passengers by reason of the gas.

One of our technical exchanges which has had a remarkable success in the last few years, and a success which it is always a pleasure to note, for it is conducted with much ability and fair-mindedness, is the *Electrical Engineer*. Last April this journal moved into its present quarters in the Mail and Express building, 208 Broadway, New York, where its offices now occupy the entire eighth story of the Fulton street wing, covering a floor space of 2,000 sq. ft. On Wednesday of this week the owners and staff of the journal gave a house warming which was largely attended by engineers, journalists and business men, who were glad to offer their congratulations upon the prosperity of the paper and the comfort and convenience with which it is housed. The *Electrical Engineer* was begun as a monthly, Jan. 1, 1882, under the name of the *Electrician*. Two years later its name was changed to the present title, and in April, 1890, it was made a weekly. It began with an office force of two men and a boy, and now has a large staff at its New York office and maintains branch offices in Boston, Chicago and Philadelphia. In 1894 it was edited by

Mr. F. L. Pope, assisted by his brother Mr. R. W. Pope. In 1886 Mr. George M. Phelps became associated with the Papes on the editorial staff and is now the President of the corporation. The editors are Mr. T. Commerford Martin, who is also Vice-President, and Mr. Joseph Wetzler. Mr. Wetzler is also Secretary of the corporation. Mr. George B. Muldaur is associate editor. We offer to the *Engineer* our hearty congratulations on its prosperity and our best wishes for its continued success.

The United States Grand Jury has found bills of indictment against 24 iron manufacturers of Pittsburgh for obstructing navigation by unloading cinders and refuse into the channels of the river flowing past the city. It is high time that some steps of the kind should be taken against the numerous iron works in the State of Pennsylvania to prevent their encroaching upon the channels of the streams in the mountainous districts, as well as the navigable waters, by dumping cinders and slag along their banks and thus contracting the water way and increasing the danger from freshets. It is not only the manufacturing establishments, however, that are to blame for this. In many towns the riparian owners have been permitted by the authorities to encroach on the natural water way in detached sections. If both sides of a stream can be embanked above the height of the greatest flood, continuously through a town, it will undoubtedly be advantageous, but no such encroachments should be allowed unless they can be carried out on a well devised and carefully considered plan and be made continuous throughout the whole course of the channel which is liable to overflow its banks in excessive freshets. The City of Johnstown is a good example of the manner in which disconnected and unsystematic encroachment on the channel of a stream produces ill effects, as was pointed out in the report of Mr. Croes to the Johnstown Board of Trade last year.

The business men of Kansas City maintain a line of steamboats on the Missouri River for the purpose, as avowed by the manager of the line, of regulating the railroads. Commissioner Vaulandingham, of the Kansas City freight bureau, has recently made a statement telling of the success of the scheme. There are three boats of 1,100 tons each, and the total investment is \$135,000. The business just about pays expenses. Two of the boats make regular weekly trips between Kansas City and St. Louis when the water is high enough. The other boat is now on the Ohio River, and all three are used to the best advantage on the Mississippi when the season closes on the Missouri. The fact that the railroads take freight from a large extent of territory to all the so-called "Missouri River points" at equal rates makes it very hard to compete with them, but on the whole Mr. Vaulandingham thinks that the existence of the boat line has been a factor in keeping freight rates from rising. He does not claim to have brought about any reduction.

The last issue of the *Chronicle* contains a summary of the net earnings of the railroads for August, and for the eight months ending with August. It appears that on 129 railroads, the gross earnings increased \$3,785,330 over August of 1891; the operating expenses increased \$3,229,458, and the net earnings \$555,881. For the eight months from Jan. 1 to Aug. 31 the reports of 134 roads give an increase in gross earnings of \$28,687,000, in operating expenses, \$24,267,678, and in net earnings, \$4,370,018. One marked characteristic of the year is the continued heavy expenditure charged to operating account; the Chicago, Burlington & Quincy, for example, with a gain in gross earnings of \$559,356 in August over August of last year gains but \$26,728 in net. The Mexican and Southwestern groups show the most decided improvement in net earnings, while the poorest showing is made by the trunk line group. The Southwestern group shows an increase in net of 20.62 per cent, and the trunk line group a loss of 8.96 per cent.

It would be a deplorable circumstance if the French public should be led to invest still other millions of francs in the Panama Canal, and we cannot believe that the recent attempts to resuscitate that enterprise will be successful to the extent of squandering further large sums from the savings of the French peasants and bourgeoisie. In 1889 Mr. Foster Crowell made a professional visit to the Panama Canal works solely for the purpose of getting at the real facts, and for his own personal information. Knowing this, we asked him to give the readers of the *Railroad Gazette* a short statement of his opinion of the present condition of the scheme. That will be found in another column, and doubtless it will have some effect in correcting false impressions that may have been aroused by the recent efforts to raise more money for the canal.

The St. Louis & Suburban Electric Street Railroad has put on a mail car 16 ft. long, which is being run from the station of the road, at Sixth and Locust streets, to Wells Station and back. The postmaster of St. Louis has for some time used the electric street cars to facilitate the work of the carriers, and what he has done has been reported in the *Railroad Gazette*. The present experiment is in continuation of the same general plan, and it is hoped to make this service a regular thing. The government has not yet, however, made any appropriation, and the railroad company fitted up the mail

car at its own expense. At present three trips a day are being made, and there are two clerks on the car to do the work. There are three branch post offices on the line.

NEW PUBLICATIONS.

Johnson's Tables; Reprinted from the Theory and Practice of Surveying. By J. B. Johnson, Professor of Civil Engineering, Washington University. New York: John Wiley & Sons. 1892. Price, \$1.25.

This volume includes stadia and earthwork tables, four-place logarithms logarithmic traverse tables and tables of natural functions, tables for map projections, etc. In a note the author says that the great use made by engineers of three of the tables, that is, the four-place logarithms, the stadia table and the table of prismatical volumes, has necessitated binding them in a more convenient form, and, as the cost was not materially increased, he has added other tables and the entire chapter on Measurement of Volumes from his book on Surveying. The stadia tables are those computed by Mr. Arthur Winslow, State Geologist of Missouri. The four-place table of logarithms is taken from that well known and most valuable book, *Lee's Tables and Formulas*. The table of prismatical volumes was computed by Professor Johnson, and he believes it to be the only table giving volumes by the prismatical formula at one operation. Various fundamental or useful trigonometric formulae are given; also a table for converting metres, feet and chains, and, finally, a table of azimuths of polaris for all hour angles.

Convention of the American Street-Railway Association.

The eleventh annual meeting of the American Street-Railway Association was held in Cleveland, O., Oct. 10-21, 1892. President John G. Holmes, of Pittsburgh, called the Convention to order and introduced Hon. William G. Rose, Mayor of Cleveland, who made an address of welcome. The address of welcome of the Mayor was followed by the address of President Holmes, from which we give a few extracts:

This city offers a fine opportunity to study practical street railroading. Here we see the most advanced ideas of construction, the highest development of the electric system, and a splendid new cable plant, as near perfect as capital, invention and engineering skill have been able to make it. And by the way of contrast and historical interest, we find a few horse car lines to remind us of the meetings a decade ago, when we used to grow excited over discussions of the relative merits of the horse and the mule as a street railway motor. . . . This is pre-eminently an electric age, and most of us believe that as yet we are only standing on the threshold. The horse and his half brother, the mule, are destined to disappear. The cable system, from its very nature and cost, must be confined to the thickly populated districts of large cities, but there seem to be no limitations to the electric railway. The congestion of traffic in our business centres, the increasing throngs of passengers of the working class nights and mornings, as the day of tenement houses gives way to the age of suburban cottages, the safeguards against accidents required by the exigencies of rapid transit, the labor question, the unjust and burdensome taxation of corporations, the ways and means of increasing traffic and reducing the cost of maintenance and operating expenses, give us plenty of things to talk about.

Following extracts are from the report of the Executive Committee:

It will be seen that it was the judgment of your committee that electricity, having come to stay, should be considered carefully and largely at this meeting; and we therefore provided for the preparation of reports on a number of subjects of vital interest to the members of the Association in regard to electrical construction, equipment and operation. The subjects were selected with great care and assigned to gentlemen in every way competent to treat them understandingly and profitably.

A paper was read by Mr. George W. Baumhoff, of St. Louis, Mo. It was entitled "A Model Electric Street Railroad Roadbed and Underground Wiring." It was long but extremely elementary, and would give no information to the readers of the *Railroad Gazette*.

The hour for taking a recess having arrived, the discussion of Mr. Baumhoff's paper was deferred until the evening session.

The Secretary then read letter of invitation from the Short Electric Railway Company, inviting all in attendance to visit the works of the company, and take luncheon, on Wednesday afternoon. A letter was also read from the Walker Manufacturing Company, of Cleveland, inviting the delegates and others to visit their works on Friday, and take luncheon as the guests of the company.

WEDNESDAY EVENING SESSION.

Mr. EPPLEY, of Orange: I would like to hear the experiences of the gentlemen in reference to the merits and demerits of the track chair, as compared with the recent form of girder rail, 9 or 10 in. high.

Mr. PAYNE, of Milwaukee: Up to within a year ago we used the girder rail on chairs—we had 20 miles of road of that construction—and about a year ago we commenced to lay the 8-in. rail, 88 lbs. per yard, spiked directly to the ties. Ties are laid 20 in. apart, centres. The rail on the chair has not proven satisfactory, and we are replacing it in some places. The other rail is very satisfactory, indeed; you can hardly tell where the joints are. We think we have the best track in the world.

Mr. LITTELL, of Buffalo: The road I am connected with has lately contracted for 20 miles of track, with the privilege of increasing it 10 more, and we are going to use a 9-in. girder rail, without chairs; splice bars $\frac{1}{2}$ in. thick and 32 in. long; twelve 1-in. bolts; tie rods every 5 ft., 8 ft. ties 3 $\frac{1}{2}$ ft. apart, 5 x 7. We will use yellow pine or oak. The rail is 93 lbs. to the yard.

Mr. RICHARDSON, of Brooklyn: The company of which I am President recently obtained about 12 miles of 70-lb.

rail, 8 in. in depth and 4 $\frac{1}{2}$ in. wide at the base, laid on chairs. The substructure is made up of long leaf, untapped Florida pine, free from sap or defect of any kind, 5 x 9 in. x 7 ft. long. The ties were laid 2 ft. 6 in. apart from centre to centre, and under each joint we laid a special joint support of about 30 in. in length, of 40-lb. T-rail reversed, properly supported by chairs. We have not yet operated this track with electric motors; but we thought when we laid it that we would have a perfect track. I think, however, we have decided on something better, and we are now laying a 90 lb. rail 9 in. deep, 5 in. across the base, and we lay this on the same kind of ties. In addition at each rail joint we put in a 6 x 12 in. x 7 ft. tie, thoroughly tamped and laid as well as it can be. At each joint of the rail we have plates 26 in. long $\frac{1}{4}$ in. thick, supported by two rows of bolts, four in each row; I think the size is an inch and a quarter. One thing referred to in the report I am doubtful about. The gentleman said in hot weather the joints may be laid close together; if not in warm weather there must be a space.

Mr. LITTELL: The best rail to lay is a deep rail, an 8-in. rail, without any chairs. Chairs are delusion. We tamp with broken stone or gravel, as the case may be.

Mr. PEARSON, of Boston: I think we have tried nearly every joint. Up to this time we have not found a joint which is perfectly satisfactory. The Johnson girder joint is the one which gives the most promise. We have not laid any of the deep rail, and consequently we have not had any experience with it. We have, however, detected a fault which I think will be inherent in any girder rail laid on ties. The ties are cut into very rapidly by the rail. The width of the flange on the rail has not sufficient surface on the tie to prevent that, and unless you put a broad plate, 10 or 12 in. long and 6 or 8 in. wide on each tie it seems to me that the deep girder construction will go to pieces the same as all the lighter rails. In the stringer construction we get a large bearing surface.

Mr. HENRY, of Pittsburgh: I think that we have most of us been in error as to the construction of our trucks. I think that has nearly as much to do with the breaking down of our joints as anything else. I think we are all of us operating nearly the same kind of trucks. They are rigid on the axle boxes. Half of the weight of the motor and the whole weight of the truck goes down on the rail like a sledge hammer when an obstruction is met. We have got to find something that will take off that impact. We are putting an elliptical spring on top of the axle box, and suspending the whole weight by this spring.

Mr. BECKLEY, of Rochester: The T-rail is best where it can be used under the ordinances of the local authorities. My own judgment is that the best track which can be laid for electric traction is a track consisting of a rail weighing 52 to 60 lbs. to the yard, say 4 $\frac{1}{2}$ or 5 in. in depth, and where you have paved streets, giving the necessary space for your paving blocks. I would put them on stringers, vulcanized preferably, upon cross ties 2 $\frac{1}{2}$ ft. apart. The stringer should be 6 in. in width, giving you an opportunity to place the paving stones without interfering in any way with the track construction.

Mr. WASON, of Cleveland: In order to get as nearly as possible a continuous rail we made an experiment in the early part of the present year and put down about a thousand feet of track, riveting the joints with red-hot rivets, and put in by boiler makers. The rails were placed end to end as close as we could get them; 56 lb. rail spikes to the tie and six red-hot rivets put into each joint. The joints were first put together with bolts and then pulled home, and then one by one the bolts were taken out and replaced with red-hot rivets. That was on one of our suburban lines. It is true that it does not have a large amount of traffic, but it was principally done to see whether the summer would have any effect in twisting it or throwing it out of line. It was put down in March, and it is just as straight now as when first put down. The joints are absolutely imperceptible, and, in my opinion, so long as you depend upon bolts, which are bound to work loose in time, the track will be in trouble. What the result will be with this track in the winter I do not know. The hot weather had no effect on it.

The report on a "Perfect Overhead Electric Construction" was then read.

A PERFECT OVERHEAD ELECTRIC CONSTRUCTION.

Mr. Chas. H. Smith, the writer, made the following recommendations for overhead construction: The poles should be of tubular iron 32 ft. in length and made in three sections, the lower section being at least 7 in. in diameter and the other two sections 6 in. and 5 in. respectively, the insertion of the joints of the poles being at least 18 in., and the joints being made solid throughout their entire length. For curves and extra strain there should be larger poles of the same make. The poles should be set in concrete and at least 6 ft. in the ground, and should be not more than 125 ft. apart. The top of the pole should have about two per cent. of rake away from the curb and should be fitted with a suitable clamp, so that the span wire can be easily adjusted to a height of 22 ft. above the track. On top of the pole should be a malleable iron cross-arm to carry the feeder wires and guard wire spans. These cross-arms should be insulated from the poles by means of wooden plugs. Span wire should be of No. 4 B. W. G. silicon bronze wire and fastened to pole clamps by means of insulated turn buckles. The trolley wire should be No. 4 B. W. G. silicon bronze wire and should be built in sections of not more than two miles in length separated by trolley breakers. In cities and villages where there is great liability of fire it would be advisable to put trolley breakers at shorter intervals. Trolley wire hangers and pull-off brackets should be of the lightest make possible to have required strength and best insulation. The trolley wire should be put up in mile lengths with twisted splice joints covered with brass cone-shaped tubes soldered to the splices. Overhead switches should be avoided if possible, and a double trolley wire is recommended. Guard wire spans should be properly insulated from the cross arms and should be of at least No. 6 galvanized iron wire. There should be two guard wires over each trolley wire at least 3 ft. apart and 4 ft. above the trolley wire. The guard wire must be well insulated from the guard spans. Pull-off and anchor guy-wires should be of the best material and of at least No. 8 galvanized iron wire. Feed-in taps should be of at least No. 0 insulated wire and placed not more than five poles apart and should take the place of the span wire at that point. The feeder wire should be at least 30 per cent. larger than the occasion demands, should have the best insulation and should be fastened to each pole by means of locust or iron pins with mica insulators or something equally as good. Lightning arresters are of great importance on the line and should be placed at least every 1,000 ft. They can easily be attached to the poles, and can be protected by means of a box.

In conclusion, no matter what expense is incurred for

material, or care used in construction, a good line cannot be insured without a thorough daily inspection.

THURSDAY.—MORNING SESSION.

The President, John G. Holmes, having been called away, Vice-President Thomas H. McLean, of New York, presided. The report of the Committee on "Economy of Electric Street Railway Machine Shops" was read.

MACHINE SHOPS.

Very little practical information can be gathered on this subject since the evolution of the electric motor has been so rapid that no definite methods have yet been established for its care and maintenance. There is a great lack of uniformity in the operation of roads, and one can find hardly two which are following the same course as regards repairs and renewals to motor equipment. Heretofore on horse lines economy has been practiced in its severest sense and now when we change from animal to mechanical power it is hard to break away from the old methods and broaden out to the extent which is necessary to conduct the affairs of a well equipped electric system. [Mr. Bickford, the writer of the report, then shows that, while it was possible to use a cheap class of labor on horse car lines, for the proper maintenance of the machinery of electrical railroads it is highly essential that skilled mechanics should be employed.]

There is no denying the fact that to do a piece of work of any kind properly we must have proper tools. The conclusion follows that we must employ the skilled mechanic and provide him with requisite tools and machinery to do the work in a skilled manner. The next question is, shall the machine shop be simply a repair shop or shall we make it a manufacturing establishment? I wish to call your attention to the methods and practice of the steam railroads. We find here what we have arrived at through our conclusions, viz.: Complete repair shops, equipped with all the necessary machinery for doing the work in a thorough and economical manner and manned by competent help; furthermore, a thoroughly competent master mechanic at the head of the whole. We find them manufacturing a great many supply parts, even complete cars and locomotives, and everything necessary for the maintenance of the road. They have learned by experience that it is economical to manufacture in this way.

In endeavoring to get practical information on this subject from electric railroads 270 sets of questions were sent out. But 60 replies were received. Among these answers received, I found many things to strengthen my belief that it is economical to maintain a machine shop, not only for repairs, but for the manufacture of supply parts. No less than 24 roads are maintaining machine shops, doing all their own repairs and manufacturing many supply parts. They say unhesitatingly that there is economy in so doing. They give as their reasons: First, that they can make better material than they can buy. A second reason given is that there is a saving of from 25 to 50 per cent, by majority of parts. I have made a sort of classification of the answers received, and the result is as follows:

10 cars or less.—Received answers from 16 roads; 14 of these buy all supplies and repair parts and have not a machine of any kind; the other two have a drill press, small lathe and blacksmithing outfit.

10 to 20 cars.—Received answers from 13 roads; seven of these have partially equipped machine shops, do all ordinary repairs and manufacture many parts for renewals; the other six have not a machine of any kind.

30 to 50 cars.—Received answers from 10 roads; six of these have well equipped machine shops, do all repairs and manufacture most parts for renewals; the other four have not a machine of any kind.

50 to 100 cars.—Received answers from six roads; of these one has not a machine of any kind; one has only a wheel press; two have a drill press, lathe and blacksmithing outfit; the other two have fully equipped shops and do all repairs and make nearly all supply parts.

100 or more cars.—Received answers from 12; two of these have only a drill press lathe and blacksmithing outfit; nine have complete shops equipped with machines of all kinds and manufacture about everything necessary to maintain the equipment; one has a very extensive manufacturing establishment, outside of a complete repair shop, and also maintains a brass foundry. The remaining roads from which I received answers had no definite information to give. One or two said that they were getting ready to establish shops and others were undecided what they would do.

Out of the 66 roads heard from, 36 were winding their own motor armatures and field coils, and the cost of armatures varied from \$17 the lowest to \$75, the highest; the average was about \$35, including all labor and material. Fifteen roads had wood working machinery, consisting principally of saw table, band saw, surface planer and mortising machine. Seven roads are cutting their gears, but some of them find it no cheaper than to buy. They think, however, that the work and material are better, and for that reason it pays them. Others make all gears and think there is a saving in cost. Eight roads are building their cars, while several are rebuilding old cars, but make no new ones.

I will give now a few of the prices for which supply parts are being made in the shops of the different roads. These figures are an average taken from 11 roads which are using Sprague, T. H., and Westinghouse double reduction motors:

Refilling commutator (copper bars).....	\$18.50	Int. shaft (steel), T. and H., \$10, Sprague.....	\$3.00
Two halves armature bearing, T. and H., \$3.96 (single Sprague).....	1.85	Int. gear.....	3.88
Two halves axle bearing.....	3.50	Armature pinion (steel).....	5.66
Brush holder.....	1.35	Trolley wheel (brass).....	1.76
Ro-ker arm, T. and H., \$1, Sprague.....	3.00	Line frog.....	1.90
Int. pinion (steel).....	4.20	Clips for line hangers (brass).....	.15
		To bore and press on 30-in. wheel.....	.93

The average price for which roads sell scrap car wheels is \$13.65 per gross ton; the lowest being \$8, and the highest \$20.

I will not attempt to recommend the number and kind of machines a road ought to have, as it will depend largely on the number of cars they operate, but I have made up a list of machines which I find the majority of those having machine shops are using, and should judge that it covers those most necessary for the work.

One 20 in. swing, 10 ft. bed, engine lathe; one 16 in. swing, 6 ft. bed, engine lathe; one 16 in. swing, 6 ft. bed, speed lathe; one 24 x 24 in. iron planer; one No. 3 or No. 4 universal milling machine; one 45 in. upright boring mill; one 24 in. upright drill press; one 12 in. upright drill press; one 100 ton hydraulic wheel press; one open die bolt cutter and nut taper; one medium size shaper; one tool grinder; two forges with power blower; one set of emery grinders; one grindstone; necessary bench tools and fittings for machines; one 10 H. P. motor to run machinery.

Of course, roads with a great number of cars would need to duplicate some of these machines, and add some others not mentioned.

After having considered this subject, and shown you what conclusions have been arrived at, both theoretically

and practically, I want to add that in order to make a success of running a machine shop in connection with an electric road, it will be necessary to employ an electrical engineer. By this, I do not mean a handy man, or a man who styles himself as electrician, just because he has had a few months' experience in the electrical business, but one who has a theoretical, as well as a practical knowledge of mechanical and electrical engineering.

Mr. PAYNE: I hope this report will not go upon the records without discussion. I think every street rail road man recognizes the fact that in his machine shop lies the secret of the successful operation of the road, so far as producing results to the stockholders is concerned.

Mr. LAWLESS, of Paterson: There is no question that a machine shop on a proper scale is desirable for a cable or an electric road. The trouble is that when it is once started it keeps growing. It is astonishing when you get a good mechanic or machinist how he likes to get in expensive tools and other equipment, and unless you watch him carefully in a short time you will have a shop that will supply half a dozen roads. There are a good many things it is cheaper to buy than to make yourself. If you have a machine shop do not have it too expensive or too elaborate; have it in accordance with the size of the road.

Mr. RAMSEY: We had nearly all the raw material finished for us for the first three months of our operation, but found that the cost was beyond our reach, which compelled us to put in planers and lathes, and other machinery for finishing it completely, and now we get the raw material and finish it ourselves. There is a point where we draw the line, and that is in the matter of gear cutting. We cannot gear wheels as cheaply as we can buy them. The commutator used to cost us seventy-six dollars three years ago; we produce exactly the same commutator now for nineteen dollars. This relative reduction in the cost of parts applies to nearly everything in connection with our motors. I suppose, however, that this experience is familiar to most of you gentlemen.

Mr. WASON: I think there is one point outside of the machine shop that should be taken into consideration in the repairs of motors, namely, the pits in which you do your work. In our shops the pits are so arranged that you can put four cars over them, but three is all we take over each pit. We have a hydraulic lift, underneath the car, running on the track, which we have found very serviceable; and when I tell you that we have taken off two motors and put on two and had the car running out in 30 minutes you will be sure it is a handy pit. We have taken an armature out and put one in and had the car running on the road in five minutes. We have 90 motor cars and do not think we have any superfluous machines. I am sure that we have more than paid for all our machinery in the saving over what we would have to pay to have the work done. I am confident that taking the motors from underneath the car, rather than raising the car bodies, is preferable.

Mr. BAUMHOF: Several years ago I made an inspection of the machine shops and other departments of electric railroads, and among others, visited the shops of Mr. Wason's company, and I advise you all to take this opportunity of going there. When we first started in about three years ago we found the prices for the various materials connected with electric roads so high that for our own protection we were compelled to inaugurate a machine shop system. In doing so we found it profitable to press on our own wheels. We also found it profitable to manufacture our own commutators and to cut our pinions and gears, and in the matter of gears it is not so much a question of cost of the cutting as the quality of the metal used.

The report was read of the committee on the

RELATIVE COST OF OPERATING HORSE, CABLE AND ELECTRIC ROADS.

This report was signed by Messrs. Ramsey, Greene and Heines. The first great difficulty that the committee met was the lack of uniformity in methods of keeping account. The committee opened correspondence with every cable road in the United States and with representative electric and horse railroads, but the information received from the horse railroads is meagre and unsatisfactory. The replies from the other roads were given in such a way that they cannot be published in full. The committee, however, tabulates the elements that they have been able to dig out from these replies concealing the identities of the companies. The result is, a table which we should consider absolutely worthless. We find, for instance, that cable road No. 1 running 193 grip cars and 298 trailers, receives 18.064 cents per car mile and has gross operating expenses of 8.81 cents per car mile, exclusive of fixed charges. Cable road No. 3 with 54 grip cars and no trailers receives 29.840 cents per car mile, and has gross operating expenses of 16 cents per car mile. Another road with 29 grip cars and 58 trailers does not give its receipts, but has operating expenses of 6.75 cents per car mile. Another with 70 grip cars and 70 trailers has operating expenses of 20.05 cents per car mile. In fact the fluctuations are such that it is absolutely impossible to draw any conclusion from them without knowing the local conditions. The table covers eight cable roads.

From seven electric roads we find that operating expenses per car mile varied from 9 cents up to 25.44 cents. A road with 290 motor cars and five trailers having the highest operating expenses and also the highest receipts per car mile, and a road with 10 motor cars and four trailers having the lowest. The figures of electric road No. 7 are: motor cars, 37; no trailers, average daily mileage, 100 miles; receipts per car mile, 28.88; gross operating expenses, 13.54 cents. The committee compares this road with No. 3 cable road, both of which are in the same city, are of the same magnitude, and neither of which operates trailers. The cable road has greater fixed charges by 1.7 cents per car mile. It has greater gross receipts by nearly one cent. Its operating expenses are 2.47 cents per car mile greater than those of the electric road. The total investment is over twice as much in the case of the cable road. The committee does not pretend to make any definite conclusions, but it squints very strongly toward greater efficiency for the money invested in electric roads, although it says that electric roads are as yet with few exceptions in the dark as to what they are doing. However, 89 per cent. of the electric roads heard from report dividends of from 5 to 12 per cent.

Mr. BALDWIN, of Cincinnati, made a statement giving the comparative cost of operating cable and electric roads in Cincinnati, and said that as to the actual cost of operation, per car mile, it was found that the cable roads were far cheaper to operate than electric cars over the same route. It requires more than double the men to clean motors and to make usual repairs to electrical apparatus. Most of them are high priced men in place of being ordinary mechanics, as in the case of the cable, so that when the cost of this labor is taken into account it is found to be fully three times that necessary

to keep the cable cars in good order. In operating an electric road, especially in heavy rain or snow storms, it is impossible to maintain the same regular service that it is possible with a cable system.

Mr. RAMSEY, of Pittsburgh: I would say in answer to the gentleman who has just spoken that he is in line with our committee. The committee in their investigation came across several cases similar to his own. Outside of a personal investigation of the subject there is no better way to get at the matter than by the appointment of a committee such as he has suggested. I might argue in support of the report presented this morning, for a long time, but I will spare you. The report was presented to the second largest cable railroad in this country for a preliminary reading, and it was returned with the statement that "our views on this important subject are fully expressed in the attitude taken by our Board in regard to further extensions of some thirty miles of electric railroad, which we are about to build."

Mr. LAWLESS, of Paterson: I had the honor to be connected with one of the first cable lines built in this country, and have since been connected with the construction of a number. I was always a strong advocate of the cable, and still am, in its proper sphere. The cable railroad sphere is limited; but in that sphere it holds its own. There are some districts where I claim cable roads can be operated more economically than any electric railroad. As regards car mileage, I find that some roads have wonderful results in the operating expenses per car mile. In these districts where the electric cars are run into sparsely settled sections the results are better than with cars run in thickly populated portions. Where you can run at the rate of about 30 miles an hour you can make about 180 miles a day; but in the heart of the city you can only make from 85 to 90. If you pay the same wages per day, the results are better in the former case; so that it is pretty hard to get accurate figures in that respect. The results were rather in favor of cable lines three or four years ago; but since the single reduction motors have come in, and the cost of repairs has come down, in thickly populated sections, even the electric line is going to press the cable pretty hard. We have no reason to expect that we have come to the end of improvements in motors, and as these progress the conditions will be increasingly in favor of electric traction.

An invitation from the Walker Manufacturing Co., of Cleveland, to visit their works at 10 o'clock, Friday morning, and partake of luncheon, the guests to be conveyed in carriages to the works, was read and accepted.

THURSDAY AFTERNOON SESSION.

The first business was the Report of the Committee on Standards. Mr. Crosby, the Chairman, said that it was scarcely expected that the report would be discussed. It was important, however, that some attention should be given to the subject of the rating of the motors. As stated in the report, it was the most difficult, and at the same time one of the most important matters to be determined. He hoped that some expression would be given concerning the two methods proposed in the report. He was exceedingly anxious to have the matter determined, and hoped the Association would give an expression in favor of one of the methods. The report was then read.

STANDARDS FOR ELECTRIC STREET RAILROADS. The portion of the report relating to method of accounting advises the division of expenses into the three subdivisions of transportation, maintenance and construction. Transportation expense includes wages, fuel, provender, lubricants, wrecking, etc. Maintenance expense includes the keeping of the properties in their original condition and consists of the amounts expended upon repairs of track, buildings, cars, power plant, engines, etc. Construction expense includes everything which adds to the value of the original plant, such as additional buildings and machinery, and new tracks laid, less the value of old ones taken up. It is also recommended that much greater care be taken in accounting for material than has heretofore been the custom. The unit for comparison which has been advised is the car mile, two standard 16-ft. cars being equivalent to one double track car.

In order to obtain the dimensions of car journals to recommend, the committee corresponded with several truck manufacturers, if the electrical manufacturers continue to increase the weight of their motors, these dimensions should be increased. The data presented were gathered from railroads using a lighter equipment than that which is now being put upon the market. It is absolutely impossible to standardize an appropriate size, considering the change of weight, but the following seems to be the best:

Diameter of axle, 3 1/4 in.; diameter of car axle journal, 3 in.; diameter of axle wheel seat, 3 1/4 in.; length of car axle journal, 8 1/4 in.; diameter of car wheel, 33 in.; weight of car wheel, 330 lbs.; diameter of trolley wheel, 4 1/4 in.; width of trolley wheel, 1 1/4 in.; depth of groove in trolley wheel when new, 1 1/4 in.; size of key way for axle gear, 3/4 in. by 6 in.; distance between hubs of wheels measured along the axle, 45 in.

Concerning another mechanical dimension, consideration of which was referred especially to the writer (Mr. C. W. Wason), a large majority of the numerous persons addressed on the subject recommended No. 0 B. & S. gauge as the best size for standard trolley wire. It is further understood that such trolley wire shall be of hard drawn copper; its conductivity will be 98 per cent. of the standard in the usual tables used; its tensile strength close to 55,000 lbs. per square inch.

Then follows a list of the terms used on electric railroads which we do not reprint.

In regard to the rating of motors, it is advised that a motor shall be known by the horizontal effort which it can apply to a car at a speed of 10 miles per hour, the standard 33-in. wheels previously recommended being used on the car and whatever gear may be preferred by the manufacturer. Thus for the present, calling a given motor 600 x 10; this meaning that at a speed of 10 miles per hour the motor in question will develop a horizontal effort of 600 lbs. Later, however, the same machine would be satisfactorily designated as a 600-lb. motor, the standard speed being taken for granted. At the same time as street railroad men begin to go into suburban enterprises, in which higher speeds than those now familiar must be attempted, it will be easy to revive the expression for the speed at which a motor is rated, and we may thus expect to see motors described as 600 x 20, 600 x 30, etc. This high speed extension of electrical motor work, and especially its extension in the same hands as those now directing ordinary street traffic, makes it especially important that some rating should be adopted which will take speed into account, as otherwise confusion will inevitably result. It goes without saying that much remains to be told concerning a motor after its horizontal effort at a given speed shall be expressed, and a part of the recommendation of your committee is that an implied part of the rating of a motor lies in this, that it shall be able to perform its rated work continuously without a rise of temperature exceeding 75 deg. C. over the atmospheric temperature.

In regard to the efficiency, desirable as it is to be informed on that point, it seems too difficult to be involved in any rating which shall be frequently and properly used.

Another method of rating motors which is presented as the second choice of your committee is as follows: That two terms should be used, one giving the horse power of the motor at which it can work continuously at a safe temperature, the other its maximum horse power. As has been explained, it is a feature of all electric motors that their maximum rate of work is done at 30 per cent. efficiency. Nothing is more essential to be established, therefore, than the maximum work the motor will do. Following this method, which was suggested by Mr. Chas. A. Lieb, a given motor might be known as 15 H. P. or as 20 H. P., etc., concerning the first machine named, it being understood that it could do 15 H. P. of work all day long without undue heating, but under stress it could perform work at the rate of 35 H. P., the efficiency being at once known to be down to 50 per cent. It would also be understood, and go almost without saying, that the motor would be able to do 35 H. P. of work continuously; indeed it would be expected to perform such a rate of work safely for only a very short time, say from two to five minutes.

Mr. HOLMES, of New York: I desire to thank Mr. Crosby for the persistent manner in which he has been hammering into us this matter of standardizing motors. The matter of rating motors is, in my opinion, a very important one. I therefore offer the following resolution:

Resolved, That it is the sense of this convention that the standard rating of railroad motors shall be the horizontal pull which the motor can exert when running the car at 10 miles per hour with 33 in. wheels, and that so running the temperature of the motor shall not be raised to more than 65 deg. centigrade above the surrounding atmosphere after a 10 hour run.

The resolution was adopted.

The Committee on Nominations then reported the following names of gentlemen nominated for the officers of the Association for the ensuing year:

President, D. F. Longstreet, Denver, Col.; First Vice-President, A. Everett, Cleveland, O.; Second Vice-President, Joel Hurt, Atlanta, Ga.; Third Vice-President, W. Worth Bean, St. Joseph, Mo.; Secretary and Treasurer, W. J. Richardson, Brooklyn, N. Y.; Executive Committee, John G. Holmes, Pittsburgh, Pa.; J. D. Crimmins, New York City; T. J. Minard, Louisville, Ky.; J. R. Chapman, Grand Rapids, Mich.; B. E. Charlton, Hamilton, Ont.

A communication presented from the Massachusetts Street Railway Association relative to the subject of the provision of proper interlocking signals at crossings of steam and electric railroads was read. It urged that the American Association send a circular to every street railroad company in America, and to the Boards of Railroad Commissioners of the different States, recommending the passage by each State Legislature of regulations upon this most important subject, to secure the greatest possible safety to passengers in electric cars at steam railroad crossings. On motion, the matter was referred to the Executive Committee.

Two more reports were read by title. These were on The Expansion of Continuous Rails, and on A Standard Rail Head. The conclusions reached in the reports were not so important but that our readers can wait another week for them. The convention adjourned to meet the third Wednesday in October, 1893, at Milwaukee.

Some Disputed Points in Railroad Bridge Designing. (Continued from page 781.)

JNO. A. FULTON, M. Am. Soc. C. E.: Suggests deriving a series of panel loads from a given system of engine concentrations by placing the latter so as to give the greatest panel load in front. He would then neglect the small advance panel load and proceed to use the remainder of the system as his moving load for the greatest stresses. With the same loads he would find the chord stresses in the end panels and add increments at each panel point to the centre. Although this method is not absolutely good, he thinks its simplicity warrants its use. For through plate girders he would proceed in the same manner and quite similarly for deck plate girders, except that the latter do not require panel loads to be found. He would compute the floor beam reactions by the law of the lever with the concentrations. He is strongly in favor of heavy bridges and would use a series of heavy engines for the moving load. Although he does not object to equivalent uniform loads for chords and webs, he would still use concentrations for the floor system. He recommends 200 lbs. per linear ft. wind pressure for unloaded, and 500 ft. per linear ft. for loaded chords, 300 of the latter to be treated as moving for spans up to 150 ft. For spans 500 lbs. long he would change the preceding amounts to 350 and 650 respectively and to proportional amounts for intermediate spans. He would carry all top chord wind pressure through the upper laterals and end posts to abutments, but would proportion each set of end or transverse bracing for one panel of wind load, and assume the indirect wind effect on bottom chords to be uniform from end to end. Plate girders up to 80 ft. in length, riveted Warren girders 80 to 125 ft., and Pratt trusses 125 to 225 or 250 ft., and subdivided Pratt trusses above the latter limit seemed to him to be the best arrangement of types. He does not object to double systems of bracing for lattice deck girders provided the two systems are not united in one before reaching the abutments. A 6 ft. 6 in. spacing for stringers commends itself to him, but he does not approve outside guard stringers, as they are an unnecessary expense. Eight inches by eight inches by 11 feet oak ties, notched 1/2 in. over stringers and spaced 12 in. or 13 in. apart centres, carrying 8 in. x 8 in. oak guards, with or without inside guards, make a satisfactory floor. He believes the ordinary methods of testing material are so different from the conditions of use that their indications are not

satisfactory; nor does he believe that end posts suffer any appreciable impact, but he would apply an incremental percentage allowance to web members expressed

by the formula $\frac{100}{n-2}$, in which n is the number of

panels. The main web members nearest the end post would take the first increment, and the next one double that amount, and so on up the series until the counter in the panel next to the end post, at the other end of the span, would take an increase of 100 per cent. for shock. He does not appear to think that metal suffers fatigue as ordinarily used in bridge structures. When wind, dead and live loads are of the same kind he would find sections for each and add them together. If end floor beams are used and well connected to feet of end posts, he thinks that the latter should be considered fixed for wind bending. He believes in nothing less than 1/2 in. for webs of plate girders in any case, while long, shallow girders will require much more. He holds that wall plates under ends of plate girders should be as short as possible, and so built as to distribute pressure transversely to the girder axis in order to prevent too much concentration of pressure, arising from deflection, on the interior edge of the wall plate; or, still better, he would use a pin or rocker support like the end pedestal of a pin span. He condemns cutting away ends of floor beams to pass lower chords through them, and would rivet the flanges, carried parallel to their ends to the posts above or below the chords. He would provide for the consequent bending of post, should any exist, by proper devices and details.

BENJAMIN DOUGLAS, M. Am. Soc. C. E.: Does not think that equivalent uniform loads can be relied upon to give nearly maximum stresses, and shows that with double cancellation trusses the error may be nearly 22 per cent. He is in favor of standard moving loads and generally approves those proposed by Mr. Waddell, but considers his tender weights too small. He would also add an alternative load corresponding to Mr. Cooper's 100,000 pounds on two axes. The wind pressures proposed by Mr. Waddell meet his approval, but he would consider the overturning wind moment on the train. The advantageous features of riveted laterals are admitted by him, but he cannot altogether approve them. He would admit the web resistance in plate girders, but criticises the author's method of computation.

SAMUEL TOBIAS WAGNER, M. Am. Soc. C. E.: Would use plate girders up to 80 ft. in length, lattice girders from 80 to 125 ft., and pin trusses above the latter limit. Plate girders 80 to 100 ft. in length seem to him extravagant, while lattice girders are equally rigid and satisfactory. He disapproves adjustable members and would avoid them. Mild steel, in which punched holes will stand a 25 per cent. drift test, does not, in his opinion, need reaming; but he would carefully observe the limit at which reaming becomes necessary. He prefers large steel eye bars to those of iron.

WM. CAIN, M. Am. Soc. C. E.: Agrees generally with Mr. Waddell, but criticises his making stress = constant $\left(1 + \frac{\frac{\text{min. stress}}{\text{max. stress}}}{\frac{\text{min. stress}}{\text{max. stress}}}\right)$. He seems to favor displacing 1/2 by a somewhat larger quantity, and makes an investigation by the aid of the results of Prof. S. W. Robinson's tests, which shows that the decrease in unit stress due to impact, divided by the moving load at rest, is $2,500(1 - \eta)$. This expression is for wrought iron, and he would advocate a similar expression for mild steel with constants properly modified.

FRANK C. OSBORN, M. Am. Soc. C. E.: States that the method of finding floor beam reactions, claimed to be new by Mr. Waddell, was used by Edwin Thacher as far back as 1885. He gives a method for finding the lengths of flange plates of plate girders, also practiced by Mr. Thacher for a number of years. He strongly favors the author's standard engines and the use of their equivalent uniform loads, but advocates a simple formula for wind pressure per linear foot of spans above ordinary lengths, rather than the cumbersome method of computing projected surfaces. For ordinary spans he regards 450 lbs. for the loaded chord and 150 lbs. for the unloaded as satisfactory. He favors increasing the clear width of single-track bridges to 16 ft., and to 29 ft. for double-track through spans. He would place stringers 8 to 9 ft. apart centres in order to reduce the impact on stringer connections, as well as to reduce the weight of floor beams and avoid the use of centre stringers. He favors pine rather than oak for floor timber. The question of unit stress is one that must still be regarded as open. The fatigue experiments have taught us much about materials, but we still lack tests of bridge members while under moving loads. He favors Gordon's formula, as it belongs to metal not strained beyond the elastic limit, while the straight line formula is based on ultimate resistance. He holds that the width of plate girder flanges should not be less than one-twentieth the unsupported length. He disapproves flanges of unequal areas, unless girders are designed by the moment of inertia. If the web is a continuous strut he would use one-sixth its area in the flange.

WM. H. BREITHAUPT, M. Am. Soc. C. E.: Approves generally the principles of construction advocated by the author, and seems to favor uniformity in specifications, but doubts whether it can be attained. He does not regard the concentration method as objectionably labori-

ous, with the aid of devices now in use, but believes the actual designing of the trusses needs much more consideration. The assumption of fixed wind loads per running foot should not be applied to spans of over 200 ft. in length. Above that limit he would take actual surfaces as prescribed by the author; and provide for the stationary wind stresses in the lower chord by means of a large unit stress. Pony trusses, 100-125 ft. long, are allowable when deep floor beams may be used, but he would deprecate their use with shallow beams, which tend, by their deflections, to vibrate the upper chords. He approves the author's plan in most respects, but would place the stringers under, or nearly under, the rails and use outer guard stringers. Guard rails should be bolted to every third tie, and nut locks should be used throughout the floor. He advocates end floor beams, but regards the author's intermediate flange, running the entire length of beam when its web is cut to pass the chord, as quite unnecessary. He strongly approves the author's views on the eccentricity of connections and induced bending by bad grouping of units; but deprecates the use of oxide of iron paints, as inducing rust, and would prescribe lead oxides or carbonates.

FRANK W. SKINNER, M. Am. Soc. C. E.: Seems to believe in the use of concentrations and thinks they should be assumed for present or future conditions of traffic. He maintains that valuable engineering work must be expected to be laborious; its accuracy is a sufficient justification of the increased labor. He holds that impact due to sudden gusts should be considered in treating wind pressure. The inclination of trusses from a vertical so as to bring their top chords near together and economize in upper laterals and secure increased stability seems to him worthy of serious consideration. He deprecates the use of very large eye-bars on account of material not being sufficiently worked. He indorses Mr. Waddell's limitation in number of flange plates allowed for plate girders, but thinks suspended floor beams may be properly used under some conditions.

A. J. SWIFT, M. Am. Soc. C. E.: Approves author's condemnation of engine concentrations, but does not approve the use of equivalent uniform loads. He suggests the use of a sufficiently heavy uniform load headed by a single weight large enough to correspond to the heaviest engine to be used for web members. For chords he would place the single weight at each panel point in succession with the uniform load over the entire span. He approves Mr. Waddell's views as to plate girders up to 90 ft., but suggests that some distinction should be made between single and double track spans. He would make 70 ft. the limit for the latter of either two or three girders, and 90 ft. for single track spans; but prescribes riveted lattice trusses and pin connections for longer spans. His upper limits for lattice trusses agree with those of Mr. Waddell's. He considers multiple web systems permissible in lattice spans, as they reduce the thickness to be riveted and afford good sustaining power when badly injured by divided trains; but he does not altogether approve pony lattice trusses, although they may be permissible with deep floor beams and stiff braces from them to top chords. He also points out that multiple web systems in lattice trusses reduce secondary bending stresses at connections with chords, and increase the general rigidity of the structure. With proper care he regards field riveting satisfactory for large plate girders. He would place stringers 7 ft. apart centres with ties 8 x 8 in. x 10 ft., and thinks Mr. Waddell's floor unnecessarily expensive. He reports a number of split angles in top flanges of stringers and girders not supported by close fitting stiffeners. In his experience every case of failure noticed in iron bridges has been in the tension flanges of stringers strained to 15,000 lbs. or more per square inch; on the other hand, top chords of old deck lattice spurs, supporting ties directly, and without angles along bottom of web plates, have been very severely overstressed for years without the first sign of injury. Mr. Waddell's views of rigid lateral system and unadjustable truss members meet his approval. He advocates the use of end floor beams to save the destructive effect on the masonry of the direct impact at stringer ends, which would otherwise exist.

(To be continued.)

Judge Brewer's Decision on the Fourth Section of the Act to Regulate Commerce.

The United States Circuit Court of Appeals at St. Paul has rendered a decision which puts a novel construction on the long and short haul section of the Interstate Commerce law, and which has excited a good deal of comment.

The cases are: The Chicago & Northwestern Railway Co., plaintiff in error, vs. John Osborne, defendant in error, in error to the Circuit Court of the United States for the southern district of Iowa, central division, and the Chicago & Northwestern Railway Co., plaintiff in error, vs. H. A. Junod, et al., error to United States Circuit Court, southern district of Iowa. Reversed and remanded for further proceedings in accordance with opinion. The opinion is by Justice Brewer.

The defendant in error, plaintiff below, recovered a judgment in the Circuit Court for \$225 for alleged overcharges on corn shipped from Scranton, Ia., to Chicago. The action was brought under the Interstate Commerce Act. The defendant owns and operates a railroad from Missouri Valley, on the Western border of Iowa, to Chicago. Scranton is a town in Iowa on this line 88 miles east of Missouri Valley, and so much nearer Chicago. Blair, Neb., is a point on that road 13 miles west of Missouri Valley. While the Fremont, Elkhorn & Missouri River Valley Railroad Co. is an independent corporation, a majority of its stock belongs to the

defendant company, which controls its operations. During the month of January, 1888, there was in force a local tariff of rates charged on defendant's road. It was published at Scranton, and made the rate on corn from Scranton to Chicago 18 cents per 100 pounds. Shippers to Chicago paid that rate, the plaintiff among them. There was uniformity of rate as to such local shipments. At the same time the tariff on cars shipped through from Blair, Neb., to New York was 38½ cents; to Boston, Philadelphia and Baltimore sums slightly above and below this figure. The through rate was made up in this way. By agreement between the defendant and Eastern companies corn was shipped through to New York from Turner and Rochelle, two small stations on the defendant's road, one 30 and the other 70 miles west of Chicago, for 27½ cents, 3½ cents of which went to defendant and the balance to the Eastern companies; and by agreement between the defendant and the Fremont, Elkhorn & Missouri Valley Railroad Co., the rate from Blair to Turner and Rochelle on cars shipped to New York, Boston and Philadelphia, or Baltimore was 11 cents. Of that through rate the defendant company received for carrying the whole line of the road less than the local tariff of 18 cents charged from Scranton to Chicago. The joint tariff was not published at Scranton and no knowledge of it was given the plaintiff until Feb. 24, and until that time he made no application for shipment beyond Chicago. Thereafter he shipped to Boston and received the benefit of the through tariff.

In his opinion Justice Brewer says:

The case must be determined exclusively by the provisions of the Interstate Commerce law as originally passed. No question was raised as to the reasonableness of the charge of 18 cents from Scranton to Chicago. Congress has not attempted to require that the tariffs on all roads be uniform, nor to place a limit in figures beyond which no company may go in its charges. The laws of business and of competition have as yet been deemed sufficient restraints in that direction. The Rock Island is between Chicago and the Missouri River, a parallel and competing road with the defendant company, yet there is nothing in the commerce act which compels either company to charge for through and local transportation the same as its competitor.

Where two companies owning connecting lines of roads unite in a joint through tariff they form for the connecting roads practically a new and independent line. Neither company is bound to adjust its own local tariff to suit the other; nor compellable to use a joint tariff with it. It may insist upon changing its local rates for all transportation over its line. If they make a joint tariff it is not a basis by which the reasonableness of the local tariff of either line is determined. To illustrate—On the defendant's road the distance from Turner to Chicago is 30 miles, on the Lake Shore line from Chicago to Cleveland it is 200 or 300 miles; the defendant company may charge 15 cents for transporting grain the 30 miles, providing that be, in fact, only a reasonable charge for the service, although the Lake Shore company charges no more for transporting it from Chicago to Cleveland; and the fact that the rate on each line is 15 cents for the distance named will not prevent the two companies from making a joint tariff for grain shipped from Turner to Cleveland of 12 cents; less than the tariff of either. It is not estimated that the two companies, with a joint line, can make a tariff from Turner to Cleveland higher than from Turner to Buffalo, or for any other intermediate point between Cleveland and Buffalo, for when the two companies by their joint tariff make a new and independent line, that new line may become subject to the long and short haul clause. But a through tariff on a joint line is not the standard by which the separate tariff of either company is to be measured or condemned. No power existed at common law and none is given by the act to court or commission to compel connecting companies to contract with each other to abandon full control of their separate roads or to unite in a joint tariff.

In the "long and short haul" provision of the law the use of the word "line" is significant. Two carriers may use the same road, but each has its separate line. The defendant may lease trackage rights of any other railroad company; but the joint use of the same track does not create the "same line" so as to compel either company to graduate its tariff by that of the other. In this act joint tariffs are recognized, and, if Congress had intended to make the local tariff subordinate to or measured by the joint tariff, its language would have been clear and specific.

In the debate which accompanied the passage of the bill by Congress it was stated again and again that the line formed under the joint tariff of connecting companies was one separate and independent from that of either of the connecting companies, and the commission has constantly recognized the same thing. There is no pretense that any shipper at Scranton or other point on defendant's line further from Chicago than that was charged less for shipping grain to Chicago than that. There was no violation of the "long and short haul" clause by the defendant in respect to its own line. Nor did the defendant, acting with Eastern companies on the line made by its road in connection with theirs, charge or receive for grain shipped from Scranton or any point West to any Eastern point less than the through tariff.

Scranton was noncompeting point. No other line, so far as appears, touched the place, and hence no publication of the joint tariff was required. The defendant was under no obligation to advise the plaintiff when and how to ship his grain. It fulfilled its legal obligation when it published its local tariff. The jury should have been instructed to find a verdict for the defendant.

TECHNICAL.

Manufacturing and Business.

A meeting of the Central Bridge & Engineering Co. of Peterboro, Ont., was held last week and organized as follows: William Cluxton, President; James Kendry, Vice-President; Directors, W. H. Law, John Carnegie and James Stevenson, M. P.; Secretary, George Smith. Mr. Wm. Law still retains the position of Manager and Chief Engineer of the works. Some large contracts have been received, including orders for 13 bridges.

Articles for the incorporation of the Eureka Automatic Car Coupler Co. have been filed in Michigan. The capital stock of \$25,000 is held by James M. Stark, Henry L. Humphrey and James McLaren.

Iron and Steel.

The stockholders of the Colorado Fuel and of the Colorado Coal & Iron companies ratified last week the consolidation already agreed upon by officers of those companies. The new company will be known as the Colorado Fuel & Iron Co. Of the \$9,250,000 common stock to be issued, \$5,250,000 will be distributed to the Colorado Fuel Co. stockholders at the rate of 175 shares of new to each 100 shares of old stock, and \$4,000,000 will go to the Colorado Coal & Iron stockholders at the rate of forty shares of new to each 100 shares of the old stock. The latter will also receive 60 per cent. in the stock of the Colorado Coal & Iron Development Co., a new company formed to take over the agricultural and town lot property of the Colorado Coal & Iron Co.

New Stations and Shops.

The following structures for the Great Northern have been completed: brick freight house at St. Paul, 500 x 55 ft.; Washington avenue passenger station, Minneapolis, and passenger depot at Casselton, N. D.

Freight Yard of the Chicago, Milwaukee & St. Paul at Galewood, Ill.

The above named road is constructing a switching yard at Galewood, near Chicago, which, in its general features, is designed on the plan of the Pennsylvania yard at Altoona, described in the *Railroad Gazette* of July 29 last, page 557. The Galewood yard will, for the present, however, be of moderate size, though ground has been secured sufficient for three large yards; one of 45 tracks for general work; one of 25 tracks for holding freight which is detained for shipping orders, and a third yard, of 40 tracks, similar to the first one. About 25 tracks of the first yard and 4 tracks of the second are now under construction. As at Altoona, the principal peculiarities are a uniform descending grade eastward and the concentration of the switch levers. In the present case the descending grade is 37 ft. per mile. The yard begins at Galewood and will extend eastward to Cragin. The switches are to be worked by compressed air, controlled by electricity; the Westinghouse non-interlocking apparatus being used, the same as at Altoona. There are six receiving tracks, so that three poling engines can work at once.

Hall Signals on the Memphis Bridge.

The Hall Signal Co., of New York and Chicago, has furnished two of its electric disc signals for blocking the section of road on and adjacent to the bridge over the Mississippi at Memphis, which is operated by the Kansas City, Fort Scott & Memphis Railroad. There are no track instruments and no automatic action. Each signal is controlled by a wire running to the office of the operator at the opposite end of the bridge, so that it cannot be cleared to admit a train upon the bridge section without that operator's consent. This bridge is single track.

Drop Tests of the New Van Dorston Coupler.

Drop tests were recently made at Washington of the Van Dorston coupler with malleable head and steel knuckle. The weight of the hammer was 2,000 lbs. and the falls as follows: Three of 8 ft., two of 15, one of 40 and one of 42. The last blow bent the knuckle three sixteenths of an inch, and there were no cracks.

Fall of False Works.

Two spans of the false works under a bridge constructing on the Pacific extension of the Great Northern fell under a work train on Oct. 24. Seven men were killed, and about 11 more injured, five of them it is thought fatally. These men were in the employ of Messrs. Shepard, Sims & Co., the contractors. A tracklaying machine, two car loads of ties and timbers and several car loads of rails fell 60 ft. into the river. The accident is said to have been due to undermining of the false work by the water in the stream. This part of the line had not been delivered to the Great Northern Co.

A New Carbonic Acid Gas Motor.

The New Power Company, of No. 10 Wall street, New York, have been engaged in the development of a carbonic acid gas motor that possesses some novel features. The engine is in general appearance and construction nearly the same as an ordinary steam engine, with the exception of the valve motion, which is a combination of the link, the Corliss and the designs peculiarly applicable to the new motor. The carbonic acid or CO₂ is stored in heavy cast cylinders in a liquid condition under a pressure of about 1,000 lbs. per square inch, and is admitted direct from this case to the valve chest without the intervention of any reducing valves. The admission ports for the engine (cylinders 4 in. diam. and 6 in. stroke) which is in operation, are only ½ in. in diameter, and the valves are rubber seated and given a mere shake, so that they do not really leave their seats but just loosen a trifle. The difficulty of intense cold due to high expansions is met by heating the admission pipe near the cylinder with a gas jet, although the engine can be run without this heating, as it is claimed that the small intermittent jet will not freeze. The engine, which is placed upon a platform street car, works quickly and handles very easily, giving perfect control of the car at the speeds which it is possible to attain within the limits of a building. The pressure of the admission has not been fully determined, but it is evidently below the 1,000 lbs. of the liquid CO₂ on account of the wire-drawing through the admission ports. The cost of operation is estimated at about 10 lbs. per horse power per 24 hours continuous

service at the rate of three cents a pound. As soon as proper drawings can be made, and further experiments carry out to a fuller demonstration the value of the machine, we shall publish full details of its construction, with records of the work which it has performed and the economy of the same.

Block Signals on the Reading.

An officer of the Philadelphia & Reading informs us that the company has decided to put automatic block signals on about 200 miles of the road as soon as possible. The lines to be equipped are Philadelphia to Pottsville, 93 miles, to Bethlehem, 55 miles (from the junction), and to Bound Brook, 55 miles. The latter, when completed, will make a through line from Philadelphia to Jersey City under automatic signals, the Central of New Jersey being already equipped with the electro-pneumatic system.

Cruiser No. 6.

The act authorizing the construction of this cruiser is dated Sept. 7, 1888, and she will probably be launched at the Union Iron Works in San Francisco in November, when she will be christened the "Olympia." Some modifications have been made in the original designs, which were drawn on the lines of the Spanish cruiser the "Reina Regente." As the vessel is constructed it is 340 ft. long on the load water line, with an extreme breadth of 53 ft., a mean draft of 21½ ft. and a displacement of 5,500 tons. The engines will drive twin screws and are expected to develop a maximum of 13,500 H. P., and maintain a speed of at least 20 knots. The coal capacity is 1,300 tons, which will give a radius of action of 13,000 miles, much more than the average of vessels of her class. In the main battery there will be four 8-in. breech loading rifles and 10 5-in. rapid-fire guns. In the secondary battery, 14 6-pounders, six 1-pounder rapid-fire guns, and four Gatlings. There is 4 in. of armor protection for the guns and ammunition hoists and a water excluding belt 2 ft. 9 in. thick above the protective deck completely surrounds the ship. The vessel has a complete electric lighting plant and is fitted as a flagship, with additional quarters for 16 wardroom officers, berths for 12 junior officers and rooms for two warrant officers. The full complement of crew is to be 495 men.

THE SCRAP HEAP.

Notes.

The St. Joseph & Grand Island has increased the pay of passenger conductors and brakemen about 10 per cent.

The Buffalo, Rochester & Pittsburgh has discontinued the train agents on its passenger trains, and the conductors now take up tickets the same as formerly.

The Missouri, Kansas & Texas has distributed \$5,000 among the families of the citizens who lost their lives in killing the train robbers at Coffeyville, Kan., recently.

The strike of the telegraph operators on the Atchison, Topeka & Santa Fe was declared off Oct. 22. The grievances of the men have not yet been settled, further conferences having been held this week.

The Minnesota Railroad Commissioners have just issued a revised map of the state showing a number of extensions and branches besides two new lines—the Duluth, Mesaba & Northern and the Duluth, Mississippi River & Northern. In other respects the map is the same as those issued in former years.

On Oct. 11 and 12 portions of Wyoming, Colorado and Utah were visited by a severe snow storm, which seriously blocked the railroads and interrupted telegraphic communication. Dispatches state that the snow was piled up as high as 18 ft. in cuts in some places, and that trains were delayed 24 hours or more.

The directors of the Grand Trunk are cutting down expenses in consequence of the unsatisfactory income of the road, and have announced, as an encouragement to the employees, that the directors themselves will reduce their fees by one-third, or to \$1,000 a year, a sum which most of the employees will still regard as large enough.

A dispatch from Columbus, O., bearing a somewhat apocryphal air, states that the Cleveland, Cincinnati, Chicago & St. Louis has been swindled by its conductors by the use of counterfeit cash fare checks. It is alleged that receipts from these unauthorized books were given by some conductors for about half of the fares received by them.

The Houston & Texas Central, where the cotton movement is now very heavy, has been working its freight crews to the full extent of their capacity, and one engineer received in pay for the month of September \$245. Other runners have received nearly as much and the train men have earned amounts proportionally large.

A meeting was held at Memphis this week by some train dispatchers for the purpose of establishing a protective organization. This seems to be a movement of those dispatchers who are dissatisfied with the Train Dispatchers' Association because it does not countenance strikes. That association has, according to its representatives, about 1,600 members, which is stated to be 80 per cent. of the entire number of train dispatchers in the country.

The British Iron Trade.

Board of Trade returns for September show that the shipments of iron for that month exceed in value those for any previous month of this year, though they are less than for the same month of 1891 or 1890. For the three quarters of this year the decrease is 22.4 per cent. in value or almost £5,000,000. There has been a healthy increase in the values exported to this country, principally in tin plates and hoops. In a table showing the shipments of iron and steel by countries, prepared by Iron, we are credited with 33,268 tons; British North America with 30,511 tons; British East India with 28,574 tons, and other countries with amounts decreasing to 188 tons shipped to

Turkey. At the October quarterly meeting held at Birmingham on the 13th, the tone, on the whole, was hopeful, though it is asserted by the *Iron Trade Circular* that "the iron trade is now going through one of the worst periods of depression that has ever visited it." But when the market gets through going through its visitor it will undoubtedly improve.

Tenders for Wharf Work.

The Dominion Government is calling for tenders for the construction of a wharf at Port Rowan, Norfolk County, Ont., according to plans and specifications to be seen at the Custom House, Simcoe, and at the Department of Public Works, Ottawa.

The Dominion Government is calling for tenders for the construction of the Breakwater at Point du Chene, Westmoreland County, New Brunswick, according to plans to be seen at the Intercolonial office, Point du Chene, and at the Department of Public Works, Ottawa. The Department of Public Works of Ottawa intend asking for tenders for the deep water wharf at Grosse Ile, Que., in a couple of weeks. One of the engineers of the Department estimates the cost at a little over \$100,000.

Lake Notes.

General Poe has submitted his report preparatory to giving out advertisements for the 20-ft. channel and as soon as that is approved it is understood bids will be advertised for. The localities at which this work will be done and the estimated costs are as below:

Removing obstructions at Sailors' Encampment.....	\$556,373.00
Dredging at St. Clair Flats.....	315,539.40
Dredging at Grosse Pointe Flats.....	955,225.76
Dredging at mouth of Detroit River.....	977,350.00
Removing obstructions at foot of Lake Huron.....	449,512.80
Removing two shoals near Round Island.....	140,755.00
	\$3,394,835.96

Instead of the old method of letting only as much work as the current appropriations will pay for, with the wasteful environments of that plan, General Poe is now authorized to let the whole work at one time, which is to be completed in about three years. This plan, besides saving the cost of several different contractors' plants and a large part of the interest on money expended during a dilatory prosecution of the work dependent on congressional and executive whims, will give the country the advantage of cheaper freight rates in about the shortest practicable time.

If Mr. George H. Ely, of Cleveland, is right in his prediction that boats now carrying 4,000 tons will then carry over 5,000 tons with ease, there will undoubtedly be an appreciable lowering of freight rates accompanied by some acceleration in its rate of passage. With the present depth of water the "Owego" and "Chemung" make the voyage from Buffalo to Chicago, 900 miles, in 34½ hours, and it is claimed they could, if occasion presented, reduce that time to 50 hours. These two boats are probably the fastest freight carriers yet constructed and it is claimed that there is profit in fast trips at the present freight rates. A late number of the *Buffalo Express* says that with 26 trips per season as compared with 20 the gross receipts will be more than \$24,000 greater; but there must be more harbor room and dockage facilities to render this possible.

In the meantime the lake shipbuilding yards are full of work both on freighters and passenger steamers. Five of the latter are being built at an aggregate cost of \$2,250,000. There are two in Cleveland for the Great Northern Railway Co.; two at Detroit for the Detroit & Cleveland Steam Navigation Co., and one at West Superior for the World's Fair service. These passenger boats will probably make the valuation of this season's launchings on the lakes higher than for any previous year.

The Harris Car, "Jeannette."

This car, the only one built by the Harris Palatial Car Co., is now advertised for sale at auction, the Watson Manufacturing Co. having foreclosed the mortgage which it held upon it. The company has been in trouble for some time and the minority stockholders brought a suit in the Supreme Court of Massachusetts, alleging mismanagement and asking for a receiver. This suit is still pending. The car, which was described in the *Railroad Gazette* Nov. 28, 1890, is a handsome and ingeniously designed parlor car, which has low sills between the trucks, affording space for receptacles large enough to hold the material and apparatus for lower and upper berths, so that the car can at night be converted into a regular sleeping car. The berths are lifted by a rack and pinion, and the arm chairs used in the day time are at night placed in the spaces beneath the floor from which the berths were taken.

Boston & Maine Grain Elevator.

The Boston & Maine's new grain elevator at Chelsea bridge, Mystic Wharf, near Boston, will be ready for use about Nov. 15. When finished it will contain 18 hoppers. Two tracks will run through the building, and a third part way. The superstructure will be 362 ft. long, 98 ft. wide, and 145 ft. high to the top of a cupola about 10 ft. high, which is to surmount the roof. The power-house will be of brick, 67 ft. long, 43 ft. wide and 25 ft. high, with a chimney 148 ft. in height and 14 ft. square at the base. Two Corliss engines, each of 350 H. P. will be used, with rope drives, each of which is separate. The land and foundation alone cost \$165,000; the building itself necessitates the expenditure of \$240,000, and an estimate of the total outlay, including walls, sheds, tracks, etc., places it at \$500,000.

Wharf Facilities.

There is ample opportunity for the improvement of the wharf facilities to be found on this side of the Atlantic. In this respect it cannot be said that any part of the country is ahead of any other part; in fact, the manner of unloading vessels in Boston is, according to competent authority, the counterpart of New York methods. The usual manner of unloading vessels is as follows: Instead of cranes, operated on a system of tracks, by means of which a transfer more or less direct from the steamer to the cars might be accomplished, the cases are first lowered near the water's edge by the hoisting booms of the steamer, and are here laboriously loaded on the teamster's cart, to be hauled a short distance, in Boston not exceeding three times the length of the team. Thereupon the goods are dumped out of the cart and loaded again into the cars for shipment. Without considering the expense involved in the handling of merchandise a needless number of times, the manner of doing it is about as bungling a one as could be conceived. Comparisons are said to be odious, and they become thoroughly so when the water front of our great American cities is compared with that of any fourth rate European seaport, while comparison with a carefully

planned system of hoisting machinery to be found at the docks of such ports as London, Liverpool, Antwerp or Hamburg is entirely out of question—there being nothing to compare.—*Hoisting.*

The World's Locomotives.

In a paper entitled "The Locomotives of the World," recently read before one of the branches of the Society of German Engineers, Mr. G. Lentz, of Düsseldorf, places the number of locomotives in current use at about 100,000. Of these, 63,000 are credited to the various European railroads, and about 35,000 to the United States. Speaking of locomotive building in different countries, Mr. Lentz states that while formerly Russia drew its supply of engines from Germany, England, Belgium and France, it is now independent of outside establishments and turns out its own locomotives. Sweden and Norway also have abandoned foreign markets and meet their demands in this line with native products. Italy has a number of small locomotive works, but is still dependent, to some extent, upon German, Austrian and French builders. Spain and Portugal secure the larger number of their engines from France, though patronizing also, in a small way, German and English works.

A New Explosive—Fulminate.

The *Colliery Guardian* speaks of a new explosive, the result of studies recently made by Berthelot and Turpai as to military explosives in use at the Iron Gates of the Danube, where a new and straight channel is being excavated under water. This is named "fulminate" (though it is not chemically allied to fulminate of mercury) and is said to be the most instantaneous and *foudroyant* or lightning striking explosive known. In this it is unlike fulminate of mercury, which is a detonator, and without material strength as an explosive.

The strength of this new explosive is said to lie in the fact that it is a combination of known explosives so judiciously chosen and combined that in burning there is perfect oxidation; no inert substance remaining and the niter resultant is gaseous, the disruptive force of this depending on the volume and temperature.

Its strength was thought by a committee of engineers delegated by the French Government to be greater than one and a quarter times the same quantity of dynamite with a much greater shattering effect. In addition, absolute safety in handling and resistance to freezing are claimed, with absence from exudation and retention of its explosive power after prolonged immersion in water.

LOCOMOTIVE BUILDING.

The Kings County Elevated has let a contract to the Rhode Island Locomotive Works for two locomotives, compound type, to be delivered by Dec. 1 next.

The Rhode Island Locomotive Works will complete the first double end Johnstone compound locomotive about the middle of November. These engines have been illustrated in the *Railroad Gazette*, and are of such an original design that the results of service will be looked forward to with interest.

CAR BUILDING.

The Pennsylvania & Northwestern has given contracts for 300 cars to the Lebanon Car Co., of Lebanon, Pa., and for 200 to Arthur King, Middletown, Pa.

The Kings County Elevated road, of Brooklyn, N. Y., has awarded to the Harlan & Hollinsworth Co., of Wilmington, Del., a contract for building 15 cars, all to be delivered about Dec. 1, 1892.

The Pennsylvania Co. (west of Pittsburgh) has placed orders for 600 cars, to be distributed as follows: Box and stock cars, to the Missouri Car & Foundry Co., St. Louis, Mo., and gondola cars to the Michigan Peninsula Car Co.

BRIDGE BUILDING.

Brantford, Ont.—The work on the bridge of the Toronto, Hamilton & Buffalo, to cross the river below the Grand Trunk at Brantford, has been begun, under the supervision of Chief Engineer E. B. Wingate. The contract for the steel bridge has been let to the Dominion Bridge Co., of Montreal. The bridge will be 300 ft. in length, in three spans. On the west side the work is now going on, and the first abutment will be about 400 ft. from the west shore. The course of the stream will be diverted and the bed filled in. On the Brantford side of the river the depth before the rock is reached is 25 ft. There will then be over 600 ft. of trestle work, which will carry the track nearly to Market street.

Columbia River.—The contract for the masonry piers for the steel bridge to be built for the Great Northern has been let. Work of dressing the stone has been begun.

Crookston, Minn.—The work of the superstructure of the Great Northern bridge at this city will be begun on Nov. 1. The Edge Moor Bridge Works, of Wilmington, Del., are the builders.

Helena, Mont.—The board of County Commissioners met last week to open the bids for constructing bridges in the Prickly Pear cañon to replace those washed out last summer. The commissioners did not award any contracts. The following bids were received: Doe, Hunt & Co, San Francisco, above Kisselbaughs, 80-ft. combination, \$3,820; Dearborn, iron combination, 180-ft. single span, \$4,975; iron combination, \$4,630. St. Joseph (Mo.) Bridge & Iron Co., 100-ft. span, Dearborn, \$4,720; 80-ft. span, Kisselbaughs, \$2,760. Bullen Bridge Co., Pueblo, Col., Dearborn, \$5,500; Kisselbaughs, \$2,500. Pacific Bridge Co., Portland, Ore., Dearborn, \$4,035, second, \$4,275; Kisselbaughs, \$1,410. King Bridge Co., Cleveland, near Kesslers, 200-ft. iron, \$5,750; 200-ft. combination, \$3,590; Johns and Mitchells, 100-ft. iron, \$1,790; 75-ft. iron, \$1,194. San Francisco Bridge Co., Dearborn, \$2,800; No. 2, \$1,447; No. 3, \$900; No. 4, \$820. Milwaukee Bridge & Iron Co., four bridges complete, \$5,800. A. G. Bayne & Co., Minneapolis, Dearborn, iron tubes and stone, \$2,731; Wolf Creek, \$2,366; Mitchells, \$1,400; Johns, \$1,821. S. M. Hewitt, Minneapolis, No. 1, \$2,900; No. 2, \$9,000; No. 3, \$7,300; Dearborn, 250 ft. iron, \$9,400; 220 ft. iron, \$8,363; 230 ft. combination, \$6,800; 150 ft. iron, \$7,481; 180 ft. lower, \$9,300; 130 ft. iron, \$6,384. Dierbert Bridge Co., Helena, No. 1, \$7,916; No. 2, \$3,130; No. 3, \$1,930; No. 4, \$1,506. G. E. Ingersoll, Dearborn and Wolf Creek, \$4,280; iron and steel, \$5,794; same proposition, C. \$4,038. D. \$6,030. Wisconsin Bridge & Iron Co., Dearborn and Wolf Creek, \$14,127; No. 2, \$10,715; No. 3, \$11,987; No. 4, \$9,688; No. 5, \$10,018; No. 6, \$7,512.

Jersey City, N. J.—A contract has been awarded to the Union Bridge Works of Sayre, Pa., to construct the iron approaches to the drawbridge over the Hackensack River, near West End, N. J., for the New York, Lake Erie & Western.

Rochester, N. Y.—The specifications prepared for the Court street bridge, a plate girder span over the Erie Canal, have failed of adoption by the Executive Board. Chairman G. W. Aldrich states that the Board will ask the City Council for a new ordinance for a bridge to cost about \$150,000.

St. Cloud, Minn.—The Great Northern bridge will be completed this week.

Tacoma, Wash.—The Northern Pacific proposes building a new bridge across the Puyallup River and the tide flats at Tacoma. While this work is going on all trains will run around the head of the bay, past the freight sheds and into the Seventeenth street station.

Toronto.—Engineer Williams has submitted plans for the construction of a steel overhead bridge, with wooden ramps, instead of a subway between the two sections of the cattle market. The committee has thought well of the idea, and it has decided to ask for tenders.

Tenders will be received up to Nov. 1 by John Shaw, Chairman of Committee of Works, Toronto, for the reconstruction and strengthening of the King street iron bridge over Don River. Specifications may be obtained at the office of the City Engineer.

Wheeling, W. Va.—The Wheeling & Belmont Bridge Co., which was reported a few weeks ago as preparing plans for a new bridge over the back river channel of the Ohio River at Wheeling, now has its preliminary arrangements well under way. One set of plans was almost completed when the officers decided that it would be advisable to change some of the important details and make the structure heavier. These new plans will soon be completed. The bridge will be 730 ft. in length and 47 ft. wide, with extension sidewalks. It will have three roadways, one on each side for street car track and wagon traffic and the broader roadway in the middle for wagon traffic exclusively. The bridge will have three spans resting on two abutments and two piers which are already constructed and which now carry an antiquated wooden bridge. The new bridge will be erected without interrupting traffic. W. Hildenbrand, of 1 Broadway, New York, is Chief Engineer; J. N. Vance, President of the company; A. J. Clarke, Vice-President, and Joseph Lawson, Secretary, Treasurer and Superintendent; all of Wheeling, W. Va.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Baltimore & Ohio, semi annually, 2½ per cent., payable Nov. 15.
Buffalo, Rochester & Pittsburgh, quarterly, 1½ per cent., payable Nov. 15.
Central of New Jersey, quarterly, 1½ per cent., payable Nov. 1.
Cincinnati, Sandusky & Cleveland, semi-annual, 3 per cent., on preferred stock, payable Nov. 1.
Nashville, Chattanooga & St. Louis, quarterly, 1½ per cent., payable Nov. 1.
Wheeling & Lake Erie, quarterly, 1 per cent., payable Nov. 15.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Alabama & Vicksburg, annual, Jackson, Miss., Nov. 7.
Baltimore & Ohio, annual, Baltimore, Md., Nov. 21.
Buffalo, Rochester & Pittsburgh, annual, New York City, Nov. 21.
Chicago, Indianapolis & Chattanooga, annual, Indianapolis, Ind., Nov. 15.
East Tennessee, Virginia & Georgia, annual, Knoxville, Tenn., Nov. 16.
Manhattan, annual, New York City, Nov. 9.
New Orleans & Northeastern, annual, New Orleans, La., Nov. 2.
New York & New England, special, Boston, Mass., Nov. 21, to approve the lease of the Providence & Springfield.
New York & Northern, annual, New York City, Nov. 9.
Philadelphia, Newton & New York, special, Norristown, Pa., Nov. 23, to consider an increase of bonds to \$1,600,000.
Toledo, St. Louis & Kansas City, special, Toledo, O., Nov. 14, to consider an increase of bonds to \$13,500,000.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The Roadmasters' Association of America will hold its next annual meeting at Lookout Mountain Hotel, Chattanooga, Tenn., beginning Nov. 15, having been postponed from Oct. 18.

The New England Railroad Club holds regular meetings, at the United States Hotel, Beach street, Boston, Mass., on the second Monday of each alternate month, commencing January.

The Western Railway Club holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The New York Railroad Club holds regular meetings on the third Thursday in each month, at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, N. Y.

The Central Railway Club meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November.

The Northwest Railroad Club meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station, at 7:30 p. m.

The Northwestern Track and Bridge Association meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. in the directors' room of the St. Paul Union Station.

The American Society of Civil Engineers holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The Boston Society of Civil Engineers holds its regular meetings at Wesleyan Hall, Bromfield street, Boston, at 7:30 p. m., on the third Wednesday in each month.

The Western Society of Engineers holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesday in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month. The annual meeting is held on the third Saturday in January.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Association of Civil Engineers of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 o'clock p. m. on the first Friday of each month.

The *Tacoma Society of Civil Engineers and Architects* holds regular meetings on the third Friday of each month, in its rooms, 201 and 202 Washington Building, Tacoma, Wash.

The *Association of Engineers of Virginia* holds regular meetings at Roanoke, on the second Saturday in each month, at 8 p. m., except the months of July and August.

The *Engineers' and Architects' Club of Louisville* holds regular meetings on the second Thursday of each month, at 8 o'clock p. m., at its rooms in the Norton Building, Louisville, Ky.

Boston Society of Civil Engineers.

At a meeting of the Society at 36 Bromfield street, Boston, a paper was read by George S. Rice, late Chief Engineer of the Rapid Transit Commission, on "Rapid Transit for Boston." The following were elected to membership: Henry S. Adams, of Cambridge; Charles R. Felton, of Brockton, and Alfred Stebbins, of Boston.

Canadian Society of Civil Engineers.

A meeting will be held at the Society Rooms, 112 Mansfield street, Montreal, on Oct. 28. At this meeting the discussion on Mr. Gilpin's paper on "The Use of Safe Explosives in Coal Mines, Part 2, on the Results of Experiments," will be taken up, and a paper on "Transition Curves," by Mr. H. Lordly, will be read. C. H. McLeod is Secretary.

Engineering Association of the South.

The regular meeting of the association was held at the association headquarters, Nashville, Tenn., Oct. 13. Vice-President F. P. Clute, of South Pittsburgh, Tenn., presiding. Mr. Ernest William Walpole, City Engineer of Talladega, Ala., was elected as a member. The Nominating Committee submitted nominations of officers of the association for the coming year. The election will occur at the annual meeting, Nov. 10. The programme of the evening included two papers:

"THE MINING INTERESTS OF NOVA SCOTIA."

Mr. Frank Cawley, of Montreal, Canada, presented in this paper a very full and interesting account of the mineral resources of the province of Nova Scotia, the extent to which they are developed, the facilities for shipping at the several mines and harbors, and an exhibit of the amounts of the exports of several staple minerals to the United States for several years past. Mr. Cawley presented from the official reports of the province the following three analyses of coal, which is a fair indication of the coals of Nova Scotia:

Composition.	Pictou District. (1)	Sydney District. (2)	Sydney District. (3)
Moisture.....	2.10%	0.53%	0.75%
Volatile combustible.....	29.20%	32.85%	28.68%
Fixed carbon.....	61.15%	61.59%	66.38%
Sulphur.....	0.50%	1.15%	1.30%
Ash.....	7.55%	4.81%	4.18%
Specific gravity.....	1.28%		1.29%

THE SPATHIC ORES AND IRON OF LAWRENCE COUNTY, TENN.

Mr. Thomas Sharp, of Nashville, the author, states this to be the only deposit of this ore in the South, and the only one making a successful grade of foundry iron, it being used however in a number of cases for steel making in Europe. The remarkable feature of the paper was the reports showing that the character and behavior of the iron in foundry practice was the opposite of what the chemical analyses and fracture would indicate, the reported analyses and fracture indicating a mottled or white iron while the foundry results showed it to be soft and fluid making a strong and tough casting with a low shrinkage.

The third annual meeting of the association will occur at Nashville on Nov. 10, when the President's annual address and the annual reports of committees will be presented.

PERSONAL.

—Mr. A. C. Beane, General Roadmaster of the Central Vermont, died at South Royalton, Vt., Oct. 17, of pneumonia.

—Mr. J. P. Cook, of Salem, Mass., President of the Worcester, Nashua & Rochester road, and largely interested in the Boston & Maine, to which the former road is leased, died last week at the age of 72 years.

—Mr. Alexander B. Greene, who was General Freight Agent of the United Railroads of New Jersey for a long number of years up to 1872, died at Trenton, N. J., on Oct. 21. He was interested in the lumber and coal business for some years past.

—Mr. John A. Hardy, at one time Superintendent of the Schuylkill Valley Division of the Pennsylvania, died at his home in Roanoke, Va., Oct. 23, of cancer of the stomach. He was at the time of his death Superintendent of the Radford Division of the Norfolk & Western.

—Mr. Frank Jones, for many years connected with the Pennsylvania Company in Northern Ohio, has received the appointment of Commissioner for the Traffic Association of Colorado, with headquarters at Denver. This association is composed of manufacturers and shippers, the organization being similar to those in Kansas City, Cincinnati and elsewhere.

—Mr. C. R. Fitch has been appointed General Superintendent of the New York, Lake Erie & Western Railroad, with office at 21 Cortlandt street, New York. Mr. Fitch has been Superintendent of the Eastern Division of the Erie for about two years, and was formerly Division Superintendent of the Long Island, and previously of the New York, Pennsylvania & Ohio. Mr. M. W. Maguire, at present Superintendent of the Susquehanna Division of the road, will succeed Mr. Fitch as Superintendent on the Eastern Division.

—Mr. Zenas King, President of the King Bridge Co., of Cleveland, O., died at that city Oct. 25. Mr. King was one of the early contracting iron bridge builders of this country, and the company which he organized first known as the King Iron Bridge Mfg. Co., the name being changed in the last year to the King Bridge Co., has come to be one of the important bridge building companies, and has built many large highway and railroad bridges in recent years. The last large structure was the highway bridge over the Ohio River between Cincinnati, O., and Covington, Ky.

A number of changes have been made in the organization of the Ohio & Mississippi since the recent annual meeting at which the English stockholders succeeded in electing directors favorable to the Baltimore & Ohio lease. Mr. C. C. Chandler, Chief Engineer, has resigned, and has been succeeded by his assistant, Mr. R. C. Fitch, as Acting Chief Engineer. Mr. John Wells, Assistant to the Manager and Purchasing Agent, has resigned, and his office has been abolished. The office of Assistant to the President has been created, and Mr. Frank E. Tracy, son of the new President, has been appointed to the position.

—Mr. Albert Johnson, one of the oldest locomotive engineers in the United States, figured prominently in a historical procession which was a feature of the celebration of the 100th anniversary of Raleigh, N. C., recently. The procession illustrated the history of the state and city, and an interesting feature of it was a model of the first locomotive that arrived in Raleigh, which was accompanied at that time by Mr. Johnson. The "Tornado" was the name of this engine, and it was in 1840 that it steamed into Raleigh, with Mr. Johnson's hand on the throttle. He is now 80 years of age. He was born in King William County, Va. In the fall of 1832 the first locomotive engine, afterward called the "Roanoke," arrived in Virginia from England. It was built by Edward Perry, of Liverpool, for the Petersburg Railroad. Mr. Johnson was employed to assist in putting it together. From his own recollection he gives the following dimensions of that engine: Its cylinders were 8 x 16 in.; driving wheel, 54 in. diam.; pilot wheels, 30 in.; weight, five tons. Mr. Johnson says the next arrival was the "Liverpool," which was also built by the Liverpool manufacturers. It had two cylinders 9 x 16, and four driving wheels 54 in. in diameter connected. About the same time the "Pioneer" was received. It came from Bolton, England, where it was built by Rockwell, Hicks & Co. The cylinders were 9 x 18 in.

In May, 1834, Mr. Johnson went to Richmond, where he was at once employed in the Richmond Foundry, then conducted by D. J. Burr & Co., which firm built the first locomotive ever manufactured in Virginia. They continued to construct locomotives for a number of years. In 1836 Mr. Johnson was employed by the Richmond, Fredericksburg & Potomac, assisting in putting up its first locomotive, which was named the "Richmond." Its cylinders were 10 x 16 in., with four drivers. The first American engine, for the Richmond, Fredericksburg & Potomac, was built by the New Castle Company, of Delaware, and was known as the "American." It had one pair of drivers and a truck, the driving wheels being 60, and those of the truck 30 in. in diameter; the cylinders were 14 x 16 in. In February, 1840, Mr. Johnson became Master Mechanic for the Raleigh & Gaston, at Raleigh, N. C., and was in the employ of that company for 30 years. Shortly after the war he acted for one year as Superintendent and Master Mechanic of the road, and in 1860 he was made Superintendent of the North Carolina Railroad, and held that position until its lease to the Richmond & Danville. He then retired from active railroad work, but is now, and for the past eight years has been, holding a subordinate position in the machine shops of the Raleigh & Gaston. It is interesting to state in this connection that in the employ of this same railroad company is perhaps the oldest railroad treasurer in the United States, Major W. W. Vass, who has continuously served in that capacity for 47 years, having entered the office in 1845.

ELECTIONS AND APPOINTMENTS.

Alabama Midland.—Lee McLendon, Traveling Freight Agent of the Plant system, with office at Jacksonville, Fla., has been appointed Division Freight and Passenger Agent in charge of this road, with office at Montgomery, Ala., to succeed Hadden Miller, resigned.

Alabama Western.—The following are the incorporators of this company: W. P. Jackson and W. H. Jackson, of Salisbury, Md.; H. B. Phillips, of Suffolk, Va.; George B. Robertson, of Maplesville, Ala.; D. B. Can-

non, of Whaleyville, Va.; Wilbur F. Jackson, of Baltimore; Isaac N. Jackson, of Washington; Lester C. Smith, of Montgomery.

Bangor & Aroostook.—The annual meeting of the stockholders was held at Bangor, Me., Oct. 18, and these officers were elected: Directors, A. A. Burleigh, Houlton; C. F. Bragg, J. P. Bass, B. B. Watcher, Edward Stetson, F. L. Stewart and C. A. Gibson, Bangor, Me.; J. D. Teague, Caribou; H. C. Sharp, Monticello; J. P. Hacker, Fort Fairfield. President, A. A. Burleigh; Vice-President, C. F. Bragg; Treasurer, Edward Stetson; Clerk, F. H. Appleton.

Boston & Maine.—George W. Hurlburt, for many years Superintendent of the Worcester, Nashua and Portland division has resigned, and Frank Barr, station agent at Nashua, has been appointed to the position.

Central Vermont.—C. E. Fuller, Jr., has been appointed Superintendent of Motive Power, in place of W. J. Robertson, transferred. Mr. Fuller's office will be at St. Albans, Vt., and he will have jurisdiction over all divisions.

Chesapeake & Ohio.—The annual meeting of the stockholders was held last week, the old board of directors was unanimously re-elected as follows: W. P. Anderson, Cincinnati; Decatur Axtell, Richmond; George T. Bliss, C. H. Carter, Chas. D. Dickey, Jr., C. P. Huntington, Samuel Spencer, New York; M. E. Ingalls, Cincinnati; Henry D. Wickham, Richmond.

Chicago & Northwestern.—W. E. Morse has been appointed Assistant Superintendent of the Madison Division, with office at Baraboo, Wis. Mr. Morse has been in the employ of the company about 12 years, principally at Chicago.

Cleveland, Cincinnati, Chicago & St. Louis.—At the annual meeting this week there were 121,570 shares of common stock and 69,227 of preferred voted. The vote was unanimous for the following directors to serve for three years: Amos Townsend, James Barnett, Benjamin S. Brown, Alexander McDonald and George A. Farlow.

Coos Bay, Roseburg & Eastern.—The officers of the company are: T. R. Sheridan, President; R. A. Graham, General Manager; W. E. Haines, Secretary and Treasurer; W. E. Earle, Chief Engineer. The principal office is at Marshfield, Or.

Cornwall & Lebanon.—A. D. Smith, formerly General Freight and Passenger Agent of the company, has been appointed General Superintendent of the road in place of Ned Irish, who recently resigned on account of ill-health.

Detroit, Lansing & Northern.—F. M. Drake, Assistant Superintendent, has been promoted to the position of Assistant General Superintendent of the entire system, including the Detroit, Lansing & Northern and Chicago & West Michigan. His headquarters will be removed from Ionia to Grand Rapids, Mich.

Grand Trunk.—The following circular has been issued by General Manager Seargeant, announcing recent changes of officers: Charles Stiff, having retired from the position of Superintendent of the Southern Division, James Stephenson will assume the duties of Superintendent of the system east of the Detroit and St. Clair rivers, with headquarters at Montreal. W. R. Tiffin will be Assistant Superintendent of the Western District, embracing the lines, Windsor to Niagara Falls, Buffalo, main line Stratford to Sarnia, and branches, with headquarters at London. D. Morice will be Assistant Superintendent of the Central District, embracing the line St. Catharines to Belleville, Toronto to Hamilton, and branches and Toronto Belt lines, with headquarters at Toronto. J. Webster, Assistant Superintendent of the Northern District, with headquarters at Orillia. J. M. Riddell, Assistant Superintendent of the Eastern District, Belleville to Portland and branches, with headquarters at Montreal. Peter Clarke, having retired from the position of Assistant Mechanical Superintendent, John W. Harkom's jurisdiction will be extended to the Eastern District. Edmund Wragge, Local Manager at Toronto, will, on Nov. 1, be placed in charge of the construction of the new station at Toronto, and Mr. Stephenson will have full charge of the company's operations in and around Toronto.

Great Northern.—H. C. Reese has been appointed General Agent at St. Louis, a position just created.

Intercolonial.—The changes in the staff of the road, which have been in contemplation for some time, have now been decided upon; they are as follows: F. R. F. Brown appointed Mechanical Superintendent vice H. A. Whitney superannuated; J. H. Wallace, General Freight Agent vice George Taylor superannuated. J. M. Lyons appointed General Passenger Agent vice A. Rusby superannuated.

Louisville, Evansville & St. Louis.—The annual meeting was held at Belleville, Ill., Oct. 12, and the old board of directors was re-elected with one exception. E. V. Lowe, of New York, was substituted for James Stillman, and the board is as follows: D. J. Mackey, W. J. Lewis and E. O. Hopkins, of Evansville, Ind.; Thomas W. Scott, of Fairfield, Ill.; Bluford Wilson, Springfield, Ill., and C. C. Baldwin, John L. Lawson, Marcus Meyer and E. V. Love, of New York. D. J. Mackey was re-elected President, W. J. Lewis, Secretary and Treasurer.

New York, Lake Erie & Eastern.—James G. Hubbard has been appointed Master Mechanic at East Buffalo in place of George B. Ross, who recently resigned. Mr. Hubbard was for many years Assistant Master Mechanic of the Erie, and on the opening of the Buffalo & Jamestown, now the Buffalo & Southwestern, division of the Erie, he was made Master Mechanic of that line. On the consolidation he was made foreman of the car repair shop at East Buffalo, which position he has since held.

New York, Lake Erie & Western.—H. A. Childs has been appointed Acting Master Mechanic of the eastern division, pending the appointment of a successor to C. E. Fuller, resigned.

R. K. Pelton, Division Freight Agent of the Buffalo & Southwestern division has resigned to enter mercantile business in Cleveland. He will be succeeded by F. J. Goodfellow, who has been Chief Clerk of Joseph Deuel, Assistant General Freight Agent.

Gen. Foreman Isaac Bond, of the shops in Susquehanna, has been appointed Master Mechanic of the Hornellsville shops to succeed Mr. Ransom.

New York, Ontario & Western.—Thomas Flitcroft has been appointed Division Freight and Passenger Agent of Scranton Division, with office at No. 2 Lackawanna

Avenue, Scranton, Pa., vice M. C. Carr, resigned. G. A. Page has been appointed Traveling Freight and Passenger Agent covering territory, Sidney to Oswego, with office at Oneida, N. Y., vice Thomas Flitcroft, transferred.

New York, Pennsylvania & Ohio.—At the annual meeting the old directors were re-elected as follows: Charles E. Whitehead, New York city; John Tod, E. R. Perkins, Fayette Brown, Samuel Brown, Samuel Mather, W. J. McKenzie, J. T. Wann, Cleveland; J. M. Ferris, Toledo; E. A. Wheeler, Sharon, Pa.; Henry B. Perkins, Warren; E. J. Barney, Dayton; Simon Perkins, Sharon, Pa.; Lewis Miller, Akron. The directors elected Charles E. Whitehead, President; John Tod, Vice-President; E. Tupper, Secretary, and E. R. Perkins, Treasurer.

Oregon Pacific.—A. L. Horner, of Seattle, recently Superintendent of the Great Northern's coast lines, resigned his position yesterday and has been appointed General Superintendent of this road, with headquarters at Corvallis, Ore.

Philadelphia Northeastern Elevated.—A meeting of the stockholders was held last week at the Girard Building, Philadelphia, and the following directors were elected: C. W. Bucholz, James A. Wright, of Peter Wright & Sons; V. C. Sweetman, George Boker, Isaac Schlichter, of the Schlichter Jute Works; General James Jourdan, President of the Kings County Elevated, Brooklyn; Edward Lauterbach, W. A. Road, of the banking firm of Vernillie & Co., New York, and Frederick B. Esler, Philadelphia. The Board of Directors elected C. W. Bucholz, President; L. C. Troutman, Secretary; Charles B. McMichael, Solicitor.

South Carolina.—The office of Master Car Builder has been abolished. W. F. Strong has been appointed General Foreman of Car Shops, and will have authority over all employees of the car department, located at Charleston. All other employees heretofore reporting to Master Car Builder will report direct to the office of Superintendent of Motive Power and Machinery.

Southern Pacific.—J. B. Donner has been appointed Superintendent of the telegraph lines, to succeed F. Peters, deceased, with headquarters at San Antonio, Tex.

South Florida.—At a meeting of the Board of Directors held on Oct. 15, H. B. Plant was elected President to fill the vacancy occasioned by the resignation of James E. Ingraham, and J. Moultrie Lee was elected Treasurer to fill the vacancy caused by the resignation of Dr. C. C. Haskell.

Tennessee Midland.—J. P. Meredith, Superintendent, having resigned, W. J. Hills has been appointed Superintendent, with office at Paducah, Ky. A. J. Welch is appointed Acting General Freight and Passenger Agent of the road, in addition to his duties as Acting Freight and Passenger Agent of the Paducah, Tennessee & Alabama, with office at Paducah, Ky.

Yankton, Norfolk & Southwestern.—The present officers of this road, now building, are J. M. Armstrong, President; J. T. M. Pierce, Vice President; A. Eller, Secretary, and J. K. Nash, Chief Engineer, with headquarters at Yankton, S. D.

RAILROAD CONSTRUCTION. Incorporations, Surveys, Etc.

Alabama Western.—The charter of this company has been filed in Alabama. The proposed road is to commence near the line of the South & North Alabama road near Clanton, Ala., and extend toward Maplesville, and in the counties of Chilton, Bibb, Perry and Hale, to a point on the line of the Alabama Great Southern near Cincinnati junction. G. B. Robertson, of Maplesville, Ala., is one of the directors.

Atlanta Elevated Railway & Depot Co.—The ordinance to permit this company to build its proposed elevated road over certain streets in Atlanta, Ga., has been withdrawn, for amendment, by consent of the Mayor and Council. The company does not expect any opposition to the new ordinance which will be introduced in a short time.

Allegheny Valley.—The building of a second track is now progressing on the Pittsburgh end of the River Division, and in a few days a section of continuous double track, 12 miles in length, will be completed. The next work will be to extend the second track to Kittanning. The double track work is going on between Hulton and Valley Camp, and also for about 900 ft. in Pittsburgh to connect two sections of double track, so that the company will soon have a continuous double track from the Union Station, Pittsburgh, to Valley Camp.

Arkansas & Louisiana.—A survey was commenced at Hope, Ark., last week, by engineers employed by the company. The surveys are being continued in a northwesterly direction from the terminus of the road at Hope, but the objective point for the survey is not announced.

Beaver Meadow, Hazleton, Mahanoy & Shenandoah.—A charter has been granted to a company of this name in Pennsylvania, with a capital stock of \$150,000. The line will be 25 miles long. A. Markle, J. J. McGeehan, N. C. Yost, of Hazleton, Pa.; A. P. Blakeslee, of Delano, and P. J. Ferguson, of Shenandoah, are directors.

Birmingham, Sheffield & Tennessee River.—The local newspapers report that a survey was begun last week for the proposed extension from Jasper south west to Birmingham, Ala., a distance of 42 miles. This line was surveyed a year or two ago, and, in fact, several surveys have been made and the route pretty definitely decided upon, but the efforts to secure funds have not heretofore been entirely successful.

Baie des Chaleurs.—C. N. Armstrong, of Montreal, one of the directors, and the contractor, announces that the 60 miles of road already built will be repaired at once and that 20 miles of the Eastern extension toward Paspébiac, Que., will be commenced this year, by M. J. Hogan. Hon. J. R. Thibault is the new President.

Burlington, Cedar Rapids & Northern.—Kimball & McNamara, of Sioux City, are pushing work rapidly on the extension from Forest City, Ia., westward, for which they have the contract. The line under contract is 47 miles long, and will be ready for operation about Dec. 1. As it will be left this fall, the line simply controls an important territory in northern Iowa, but does not make any connection of value. It is believed, perhaps next year, that the branch will be extended still further west, probably to Estherville, Ia., 65 miles from Forest City.

Burrard Inlet & Fraser Valley.—Several local property owners at Vancouver, B. C., are trying to prevent the city from issuing the \$300,000 of bonds voted to this road by a small majority at a recent town election. Application has been made to the Supreme Court at New Westminster, B. C., that the by-law granting the subsidy be declared illegal on account of certain specified irregularities in the election. This project is for a line from Vancouver to the United States boundary line near Sumas and it is referred locally as a "Northern Pacific extension."

Butte, Anaconda & Pacific.—A Butte dispatch says that 90 teams are working on the line of the road west of Butte, Mont., and within a few days there will be 150 teams working. The grading is being pushed at a rate of a half mile a day. Marcus Daly, M. Kirkpatrick, of Anaconda, Mont., are directors of the company, which has been organized to build from Butte to Anaconda.

Canadian Pacific.—Grading on the Pipestone branch in southern Manitoba has been completed to Reston, near the proposed end of track. This branch is about 30 miles long, and starts from a point on the Souris branch between Souris and Menteith, extending nearly due west. The company is building two other lines in Manitoba and the Northwest Territories, which it is expected to complete this year—the line from Menteith west to Souris, the town mentioned above, and the northwest extension of the Souris between Pasqua and the United States boundary.

Chicago, Indianapolis & Chattanooga Southern.—The annual meeting is to be held at Indianapolis on Nov. 15, and it is expected that arrangements for building about 63 miles of the road south of Indianapolis will be concluded at the meeting. F. L. Patrick, of Columbus, O., is Vice-President.

Chicago, Rock Island & Pacific.—The contractors are increasing their forces on the new connecting branch from Lincoln to Jansen, Neb., and it will probably be completed early in November. The track is now being laid.

Chicago & Southern.—Articles of incorporation have been filed at Danville, Ill., for this road to extend south from Chicago to a point near Paris, in Edgar County. The incorporators are Francis Hinkley and William H. Holcomb, Chicago; David T. Littler, Frank H. Jones and Bluford Wilson, Springfield, Ill.

Coos Bay, Roseburg & Eastern.—The grading has been recently resumed on this road in Oregon. The company is doing the work with its own men, and at present has about 75 men at work trimming banks and fixing up the roadbed that was built last season. One pile bridge 1,800 ft. long is nearly completed, and only one more remains to be put in to make a continuous finished grade of 18 miles. South of Marshfield, Ore., tracklaying started Oct. 10, and will be pushed on to Coquille City eight miles from the end of last season's work. The location from the Roseburg or eastern end of the line was started Sept. 12, and is being pushed as rapidly as possible. W. Z. Earle is chief engineer.

Fairmont, Morgantown & Pittsburgh.—Every effort is now being made to finish all the grading between Morgantown, W. Va., and Smithfield, Pa., before cold weather sets in, so that the tracklaying may be conducted uninterruptedly during the winter. Bennett & Talbott, who have the contract from the north side of Cheat River to Smithfield, have their work almost completed excepting a tunnel 3,000 ft. long near Morris Cross Road. This is well under way, and it can be put through probably by the middle of November. Lane Bros., who have the contract for 6½ miles of the heaviest work, have increased their force by the addition of 200 hands, and hope to have the work completed shortly after Nov. 1. Stone ballast is being broken all along the line, and it is probable that tracklaying will commence from the Morgantown end in about ten days. Work on Cheat River bridge is going ahead rapidly, the piers being above water. It is estimated that the bridge can be finished in three months, and that very shortly after that time the completed line from Morgantown, W. Va., to Uniontown, Pa., will be opened.

Georgia, Carolina & Northern.—It is announced that the trains of this road will be run into the Union station at Atlanta, Ga., by Nov. 10. The company will use the track of the Seaboard Air Line Belt road, which is now completed for a distance of about eight miles, to a point on the Western & Atlantic at Howells, and the Union station will be reached over the track of that road from that point.

Georgia Southern & Florida.—Bondholders of the road representing \$2,922,000 of the bonds met in Baltimore, Oct. 25, under call of the trustee, the Mercantile Trust & Safe Deposit Co., and endorsed the foreclosure action of the trustee. Interest was defaulted last July upon the first mortgage six per cent., which ran until 1897. The bonded debt is \$12,000 per mile. A committee was appointed to represent the bondholders in the foreclosure proceedings.

Great Northern.—Tracklaying on the Thief River Falls branch has been completed. The tracklaying was begun on the Red Lake Falls line in Minnesota on Monday. The main line from Crookston to Ada, Minn., 30 miles, and from Kelso to Grand Forks, N. D., 44 miles, has been relaid with 68-lb. rails.

Kansas City, Eldorado & Southern.—The Secretary of State of Missouri has issued a charter to this company for the extension of its line from Rich Hill, in Bates County, to a connection with the Kansas City, Nevada & Fort Smith, near the south side of Maries des Cygne River, a distance of 16 miles; also, to extend its line from West Eldorado, in Cedar County, to Aurora, in Lawrence County, a distance of 70 miles.

Kishacoquillas Valley.—This road has been located from Belleville to Reedsville, Pa., nine miles, and, as stated last week, the contract awarded to E. A. Tannis, of Thompsonstown, Pa., to do the grading, masonry, trestling, tracklaying, etc., furnish all timber for trestles and bridges, and complete the road ready for rolling stock the present year. The line will be opened for business about Jan. 15, 1893. The road will be laid with 56-lb. rails with six-bolt angle splices on white oak ties to standard specifications. The road will probably be extended in the near future and finally reach and develop large deposits of good iron ore a few miles from Belleville, Pa. Connections will be made with the Pennsylvania at Reedsville, Pa., which is about nine miles from Belleville. The company is in the market for rails and track material, either new or of first quality second hand. F. E. Whittekin, of Tionesta, Pa., with headquarters at Belleville, Pa., is Chief Engineer and Manager.

Lower California.—R. A. Graham, of San Diego, Cal., who has the contract for building this road in Lower California, states that he proposes to resume grading on the second section in December next, when the weather in that country will be more favorable for railroad building. It is thought that 50 miles of the road will be built at once, to complete the line from San Quentin to Colnett.

Mexican International.—The tracklaying on the Sierra Mojada extension, which is being built from the main line at Monclovia, Mex., will be commenced about Nov. 1. This extension is to be built northwest from the main line to the large mining district at Sierra Mojada, and the grading has been in progress for a number of months, the number of men at work being gradually increased as the contractors finished the construction of the extension south of Torreón to Durango. The work on the Sierra Mojada extension is being done by the construction company, and no general contract will be let.

Mexican, Northern Pacific.—Work has been resumed on this road, after a long delay, south of Deming, N. Mex., under instructions from the contractors, Huss, Townsend & Co., of Chicago. The roadbed formerly graded, south to the Mexican line, is now being repaired wherever necessary, and it is stated that the rails will soon be laid as far as the northern boundary of Mexico. A. T. Wilcox, the engineer of construction, is expected to arrive at Deming in a few days.

Mexican Roads.—The Jimenez & Herrerojoda railroad, of Mexico, is reported to have closed a contract with a firm of East Texas lumber contractors for 2,400 car loads of bridge timbers for the construction of that road.

Montgomery, Hayneville & Camden.—Several miles of the road from Camden, Ala., have been graded and the location is made for ten miles from that point northeast toward Montgomery. It is said that enough funds have been subscribed to build the road into Lowndes County, and the projectors expect to secure subscriptions at Montgomery, Ala., for completing the balance of the road to that town.

Montreal & Sorel.—Mr. Taillon, of Sorel, Que., de-questator of this Quebec road, has made an arrangement with Messrs. Walter Shanley, John McCarthy and J. D. Cameron to have the road completely repaired by Dec. 15, so as to have trains running during the winter.

Nashville, Chattanooga & St. Louis.—Track-laying on the Northern extension of the Tennessee & Coosa, between Guntersville and Huntsville, Ala., is under way, and trains will soon be running over the division.

New Iberia & Vermillion.—The grading has been retarded for some time past on account of the scarcity of labor, but it is now completed the entire distance from New Iberia to Abbeville, La., 16 miles. It is possible that the track may be laid to the terminus by Nov. 15, when the road will be taken over and operated by the Southern Pacific.

New Jersey Junction.—This road is building a second track from the main line of the New York, Lake Erie & Western, east of the Bergen Tunnel, Jersey City, to Weehawken. The work is being done by the company in compliance with an agreement made with the Erie when its tracks were laid several years ago, and is in connection with the extended pier and dock improvements made by the Erie at Weehawken. The distance is two miles. The road is operated by the West Shore.

Newport & Sherman's Valley.—All litigation over the crossing of the Perry County road over the tracks of this road near New Bloomfield, Pa., is now at an end, the last named company having withdrawn all opposition to the overhead crossing, and in a short time trains will be running into Landisburg, Pa.

New Roads.—A meeting of the taxpayers of Cape May County, N. J., will be held in Goshen this week to consider a proposition to build a new road from Philadelphia to Cape May. Logan M. Bullitt, of Philadelphia; Judge Howard Carrow, of Camden, and James E. Taylor, of Cape May, will speak. The project is to build a new road from a connection with the New Jersey near Landisville to Cape May, 40 miles. The distance between Philadelphia and Cape May would be 70 miles.

North Galveston, Houston & Kansas City.—Captain J. H. Barrett, who has the contract for grading the road from Virginia Point to North Galveston, Tex., a distance of 16 miles, has completed four miles, which is the worst portion of the road, as the land is swampy. The rest will be easy to grade, and he expects to have the entire road completed by Dec. 10. Ties are being collected, and as soon as the rails, which are en route, arrive, track laying will commence. The route beyond North Galveston has not been decided upon.

Ottawa, Arnprior & Parry Sound.—The number of men at work on the construction of this road is being constantly increased. Additional contracts will probably be soon awarded. The road is being built by the Canada Atlantic West of Ottawa to connect with the Parry Sound Colonization, which is now also controlled in the same interest.

A petition has been prepared by the Board of Trade for presentation to the City Council of Ottawa, Ont., asking that the council take \$100,000 stock in this road now being built west of Ottawa to connect with the road to Parry Sound.

Paducah, Tennessee & Alabama.—The tracklaying on the extension from Hollow Rock south reached the junction with the Tennessee Midland, near Lexington, Tenn., last week. The building of this line completes a route from Paducah, Ky., on the Ohio River to Memphis, Tenn., about 200 miles. The Tennessee Midland being now operated by the above company.

Pennsylvania.—Engineers have recently been making surveys for a line across the mountains from William Penn or Girardville, in Schuylkill County, Pa., to which point the company is now constructing a short line from Shenandoah to Mt. Carmel, the terminus of a branch of the Northern Central. The country is a rough one and the proposed road would necessarily have heavy grades, but it is believed that it will be built, as it would form an important link between two branches that are now separated by only a few miles. The new line would enable the company to secure a considerable tonnage of anthracite coal, and would afford railroad competition to a number of towns in northern Schuylkill County which are now only reached by the Philadelphia, Reading & Lehigh Valley.

Parry Sound Colonization.—J. R. Booth, of Ottawa, has purchased this road, which will become a part of the Ottawa, Arnprior & Parry Sound road now build-

ing west of Ottawa. The above road was projected many years ago, and in the last year the road has been built from near Elmsdale, Ont., on the Grand Trunk west about 20 miles, the work being done by W. G. Reid, of Montreal. There is still about 30 miles of road to build to reach Parry Sound.

Philadelphia & Reading.—It is said that this company is interested in the project organized by a number of Harrisburg capitalists, which proposes constructing a line from Steelton to Middleton, Pa., and connect at the first-named place with the company's Steelton branch. It is also said that a survey has been made, and the right of way gained.

Philadelphia & Reading Terminal.—The elevated structure has been completed up to Spring Garden and Ninth streets, and the false work has been erected for the through truss bridge to be built over that street, which will have a span of 120 ft. This long span has been made necessary because the city council refused to permit the erection of piers or foundation work in the street. When this bridge is erected very little work will remain to be done to complete the elevated terminal. A temporary wooden incline is being built for a connection from the Reading tracks at the street level beyond Fairmount avenue to the elevated structure at Spring Garden and Ninth streets, and this will be ready for the passage of trains about the time that the bridge at the latter street is completed. The incline will be gradually replaced with a permanent structure without interfering with the traffic. Passenger trains will be run over the elevated terminal to the station building at Twelfth and Market streets as soon as temporary accommodations for passengers can be prepared in the station. The officers expect to open the road by Jan. 1, but the date is still somewhat uncertain. The trainshed has been completed for some time, and the tracks have been laid and ballasted and freight trains have been running into the train shed over the west branch, which reaches the street level at Broad and Noble streets.

Philadelphia & West Chester.—The ordinance recently passed by the Borough Council of West Chester, near Philadelphia, authorizing this company to build into that town and occupy certain streets, has been accepted by the company, which has announced that it will proceed at once to build the six miles required between West Chester and Exton, on the Chester Valley branch of the Philadelphia & Reading, which will operate the new line.

Phillips Junction & Quarry.—The grading on this road was begun last week. This line will be six miles in length and extend from Stanbridge Station to Phillipsburg, Que., will put the people of the eastern portion of Quebec Province in communication with the Lake Champlain district and the Canadian Pacific.

Pittsburgh & Western.—Last week the eight miles of second track between Zelenople and McKim, Pa., were opened for traffic. There is now a continuous stretch of 13 miles of double track between Rock Point and Zelenople. The three miles of new second track being built between Evans City and Callery Junction will not be completed before Nov. 15. Between Pittsburgh and New Castle Junction there are now over 22 miles of second track, and this mileage will be increased before the winter compels a suspension of work.

Portland & Rumford Falls.—The bids for the proposed extension have been examined, and it is expected that the contract will be let this week, or as soon as the route is determined upon; three routes have been surveyed by Engineer A. S. Hilton. The first is from Mechanic Falls, along the Little Androscoggin through Minot Corner to the Maine Central, within two miles of Auburn. The second route is from Mechanic Falls through Poland Corner near Poland Spring, and thence to the Maine Central at the same point as that reached by the first route. The third route begins at Mechanic Falls; runs through Poland Corner, Poland Spring, and thence to Danville Junction. The first route would be nine miles in length and the other two about 11½ miles each.

Quaker City Elevated.—President C. W. Buchholz has asked for bids for building the foundation for the iron piers for supporting the elevated structure on Market street, from Second to thirteenth street, Philadelphia, and it is expected that the contract will be awarded this week. The foundations are to be of brick and concrete and will range in depth from 7 to 17 ft., according to the character of the ground. Mr. Buchholz has applied to the city authorities for a permit to open Front street from Market street, north, for foundation work on the North-western line. Prof. Herman Haupt has been appointed Consulting Engineer for the company.

Quebec, Montmorency & Charlevoix.—The work of construction on the eastern extension is advancing rapidly and soon rails will be laid as far as St. Augustin, Que. It is said that the Harbor Commissioners of Quebec, have informed the company that it must remove its station from its present location by May 1, 1893, which will force the company to run its trains to the Quebec & Lake St. John depot.

Rapid City, Pierre & Eastern.—Articles of incorporation were filed with the Secretary of State, at Pierre, S. D., Oct. 20, for a road to be built from Rapid City to Pierre, thence to Aberdeen, S. D.

Reading Belt Line.—Philadelphia & Reading engineers have begun surveying for the construction of a belt line around Reading, Pa., by which, when built, all freight trains can be sent around the city instead of through Reading.

San Francisco Belt.—The Harbor Commissioners have let the contract for the extension of the single track of the Belt road from the foot of Francisco street to Powell about a half mile. Healey & Tippetts have the contract for the grading and laying the ties for \$2,400. The terminal freight from the North Pacific Coast and the Pacific Coast roads is now run over the completed portion of the Belt line to its yard at Front street. The total cost of the Belt line to the Harbor Commissioners so far is about \$40,000.

San Francisco & Great Salt Lake.—Chief Engineer U. H. Kennedy is reported to be making rapid headway in the preliminary surveys in California, in the mountainous country between Oroville and the summit of Beckworth Pass. He was in Oroville last week. The camp of one of the surveying corps being about 12 miles out from that town.

San Pote Valley.—The contract is reported to have been let, and grading begun, on an extension 12 miles long from the present terminus at Chester, Utah, south to Mantle. The road is now operated by the Union Pacific.

Seattle Coal & Iron Co.—The engineers have completed the survey of a line from Cokedale to Palmer, Wash., where it will connect with the Northern Pacific. It is intended to commence construction of this short line soon to the mines already developed at Cokedale owned by this company. The line is about 3¼ miles long. The road is through an exceedingly rough country and will entail considerable work. Wesley Wilson is Manager and G. A. Kyle, Engineer.

Tuscarora Valley.—Track-laying on this new road has been completed from the Pennsylvania road to a point in Turbett Township, Juniata County, Pa., and in a few days passenger and freight traffic will begin.

West Virginia Central & Pittsburgh.—The company is making improvements at several points along the line. At Elkins a new paint shop 44 x 100 ft. is being erected. At Thomas a new roundhouse is being put up and grading for a second track from Fairfax to Thomas is nearly completed. New track scales are being put in at several points, embankments are being strengthened, cuts cleaned out, and the road generally overhauled. Messrs. F. A. Parsons, A. M. Bradley and Ed. Baker, who have been connected with the engineering corps which is surveying for the extension of the line from Mingo to the head of Clover Creek in Pocahontas County, returned to Beverly, W. Va., last week. They report that it will be necessary to build four tunnels with a total length of 4,000 ft., the longest being about 1,400 ft. between the head of the Tygarts Valley River and the head of Clover Creek, a distance of two miles. The entire line of this proposed extension is through very heavy mountainous country, and the line will be very expensive to build.

Wilkes Barre & Eastern.—One of the officers writes that it is expected to have the entire grading between Wilkes Barre and Stroudsburg, Pa., a distance of 75 miles, completed by Jan. 1 next. It is also expected that the tracklaying will be begun by Nov. 10.

Yankton, Norfolk & Southwestern.—The tracklaying was to have been begun south of the Missouri River this week. The grading has now been completed for 40 miles from the Missouri River to near Norfolk, Neb., and this work is now in progress on the north side of the river into the town of Yankton, S. D. Progress is also being made with the bridge work. The contractors have about 400 men and teams at work.

GENERAL RAILROAD NEWS.

Atlanta & Florida.—The effort of the Central Trust Co., of New York, to have the foreclosure sent to the United States Court at Atlanta, has been unsuccessful. Judge Newman of that court having remanded the suit to the Superior Court of Georgia, from which the case was appealed.

Baltimore & Ohio.—The directors last week declared a dividend of 2½ per cent. on the common stock for the six months ending June 30. This is the second cash dividend the company has paid on its stock since 1887. At the April meeting of this year the directors declared a dividend of 1½ per cent. for the last three months of the fiscal year of 1891. Prior to that they had declared a stock dividend of 20 per cent., which was supposed to represent the earnings of the company due the stockholders for the time the dividends were passed. It is generally accepted that the payment of this semi-annual dividend is an indication that the company is now in position to continue regular dividends on its stock at the rate of 5 per cent. per annum.

Boston & Maine.—The improvements which the managers contemplate comprise the erection of a new station at Lowell, the double tracking of the Gloucester branch, additional tracks across the Chelsea bridge to Mystic wharf; 15 miles of side tracking on the Mystic flats; abolishing a large number of grade crossings, and the utilizing of the McLean Asylum property, recently purchased by the company for terminal purposes. Beside the grain business, for which a large elevator is being erected at Mystic wharf, the company will continue to handle at Mystic wharf 500,000 tons of coal per annum, which come to it from Philadelphia.

Cape May & Sewell's Point.—Sheriff Nichols, of Cape May County, N. J., has advertised this road for sale on Nov. 25, under foreclosure proceedings instituted in the Court of Chancery by the Camden Safe Deposit & Trust Co. The amount of indebtedness named in the writ is \$40,165.

Canadian Pacific.—The company has extended its train service from Rigaud to Pointe Fortune, Que., seven miles, on the Montreal & Western road, which it operates, taking over each section as built.

Cincinnati, New Orleans & Texas Pacific.—The report of the company for the year ending June 30 shows:

	1892.	1891.	Inc. or dec.
Gross earnings.....	\$4,337,497	\$4,379,142	D. \$41,645
Operating expenses.....	3,190,809	3,024,502	I. 166,307
Net earnings.....	\$1,137,688	\$1,354,640	D. \$216,952

New York, Lake Erie & Western.—The company is building two tracks, each two miles long, for the accommodation of freight trains, between Newburgh Junction and Arden, N. Y. At each of these points foundations have been commenced for interlocking towers, which will be built to contain 24 levers, but for the present 20 levers will be used. At Middletown Summit, N. Y., and two miles west of that point, two more interlocking towers will be built, each containing 20 levers. Bids have been asked for the construction of the interlocking apparatus.

New York & New England.—President Parsons has issued a circular explaining the objects of the special meeting of stockholders to be held in Boston on Nov. 21. They are as follows: First, to ratify the leases of the Providence & Springfield, and the Meriden, Waterbury & Connecticut River; to accept the provisions of the act of the General Assembly of Rhode Island, passed April 22, authorizing the issue of bonds; to consider the expediency of reconsidering the vote of the stockholders passed March 8, 1892, contemplating the exchange of shares of the preferred stock for consolidated bonds.

New York, Pennsylvania & Ohio.—The statement read at the annual meeting gives the following figures, September being estimated: Gross earnings, \$7,286,070, an increase of \$150,000 over last year. The net income received from all sources was \$2,282,000, an increase of \$50,000 over the previous year. The net increase applicable to the payment of interest on first mortgage bonds was \$600,000, an increase of \$50,000 over the previous year. This will enable the company to pay out \$600,000 in interest on first mortgage, being two per

cent. upon first mortgage bonds outstanding. President Whitehead reported the condition of the roadbed to be exceedingly satisfactory. In the matter of rolling stock, the engines and cars of the Equipment Trust were well maintained, but the balance are not in as good order as they should be, and the lessee had not purchased any to replace those worn out. To take care of the large freight and passenger business expected next year material additions to the equipment would have to be made.

Providence & Springfield.—The Council of Providence, R. I., has passed a resolution directing the Mayor to inform the Trustees of the road that the payment of the principal on the bonds due July 1, 1892, had been defaulted, and requesting the Trustees to dispose of the property in their possession at auction sale to insure payment to the city. In regard to the above President Parsons of the New York & New England says: "The report of a default is incorrect. The New York & New England Co. has nearly two years in which to pay the bonds."

Rio Grande Southern.—The annual report is for the five months ending June 30. President Mearns states that on Feb. 1, 1892, the entire line of 1724 miles (including the Telluride branch) was completed and turned over to the company. During the subsequent five months ending June 30, 1892, the gross earnings amounted to \$244,894 and the expenses \$118,764, leaving a net earning of \$126,129 69. The country is developing very rapidly; industries are springing up at many points. The 30-lb. rail between Vance Junction and Rico has been replaced with 57-lb. rail on account of the grades and also this being the portion of the line where we may expect the most snow and upon which we will be called upon to use the rotary snow plows. We have 60 miles of 40-lb. rail, 30 miles of 57-lb. rail and 82 miles of 30-lb. rail. During the coming season we expect to replace the 82 miles of 30-lb. rail with 57-lb. rail.

Rochester, Hornellville & Lackawanna.—The sale of this road, which is included in the litigation involving the Lackawanna & Southwestern road, took place at Angelica, N. Y., last week, the Harlan & Hollingsworth Co., of Wilmington, Del., bidding it in for \$27,500. The road extends from Hornellville northward about 10 miles. This completes the sales of the various parts of the Lackawanna & Southwestern lines.

Wheeling & Lake Erie.—The company has declared a quarterly dividend of one per cent. upon its preferred stock. This is a reduction of one-quarter of one per cent., the directors having decided to reduce the preferred stock from a five to a four per cent. basis for the next nine months in order to add to the company's facilities at Wheeling. A portion of the right of way will have to be bought, and there will be the cost of construction which will be paid out of net earnings. The cost of this extension will be about \$150,000, and it is estimated that the traffic derived from it will yield the company about \$100,000 net per annum.

TRAFFIC.

Traffic Notes.

The merchants of Memphis are taking measures to establish a freight bureau.

The amount of grain arriving at Buffalo is so large that canal freight rates are very high. On Monday of this week 5½ cents a bushel was paid on wheat to New York.

The Rhode Island Car Service Association, to have control of all demurrage matters in the State of Rhode Island, has been established by the New York, New Haven & Hartford, the New York & New England and the Old Colony railroads. The office is in Providence and the Manager is E. A. Gordon.

All the lines leading from central and southeastern Ohio to Chicago seem to have taken a hand in the competition in passenger traffic which was begun by the lines between Cincinnati and Chicago, and which resulted last week in a \$6 round-trip rate between the Ohio River and Chicago. This rate was put in force at Ironton, O., and we believe is still in force.

E. N. How, President of the Mexican Freight Association, says that the Mexican railroad pool, which was recently formed by the several roads of Mexico at a meeting held in London, will continue in effect, a satisfactory arrangement having been made with President Diaz and the Department of Public Works of Mexico for maintaining the rates established by the pool.

The rush of corn to Mexico seems to be little if any abated and some of the Kansas shippers are thinking of sending shipments by boat from New Orleans to Vera Cruz. A dispatch from San Antonio last week states that the suspension of the import duty, which was to terminate Nov. 1, has been extended to Feb. 1. This, if true, goes to show that the hurrying of shipments during the past month has been mostly wasted energy.

All the roads entering Salt Lake City have made large reductions in freight rates, especially from eastern points. This is a consequence of a loud complaint from the merchants of the city, who several weeks ago entered a formal complaint before the Interstate Commerce Commission. It is said that the reductions on many important commodities average 30 per cent. The case before the Interstate Commerce Commission will probably be dropped.

At the meeting of the Passenger Committee of the Trunk Line Association in New York this week an application was made by the Canadian Pacific to handle tourist business out of Chicago to Pacific coast points. The application was denied. An effort is being made to abolish tourist business in eastern territory. One of the questions to be taken up at this meeting was the Buffalo agreement, which has been practically worthless for more than a year. One passenger agent said that they didn't touch it for fear it would drop in pieces. Buffalo rates are manipulated more than any other rates in trunk line territory.

"The Central States Dispatch."

The Philadelphia & Reading has established a new fast freight line from New York and New England to the West. It is called the Central State Dispatch, taking the name of the old line abandoned by the Baltimore & Ohio. The Baltimore & Ohio now operate chiefly over the Continental fast freight line between the seaboard and Chicago. The Reading's new line uses the Central Railroad of New Jersey from New York to Allentown, Lehigh Valley to East Pennsylvania Junction, Philadelphia & Reading to Shippensburg, Western Maryland to Cherry Run, Baltimore & Ohio to Cincinnati, "Big Four" from that city to Chicago. Mr. T. H. Noonan is the General Manager, located at Indianapolis.

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The WESTINGHOUSE AUTOMATIC BRAKE is now in use on 24,000 engines and 325,000 cars. This includes (with plain brakes) 252,000 freight cars, which is about 23 PER CENT. of the Entire Freight Car Equipment of this country, and about 80 per cent. of these are engaged in interstate traffic, affording the opportunity of controlling the speed of trains by their use on railways over which they may pass. Orders have been received for 173,000 of the Improved Quick-Action Brakes since December, 1887.

The best results are obtained in freight train braking from having all the cars in a train fitted with power brakes, but several years' experience has proven conclusively that brakes can be successfully and profitably used on freight trains where but a portion of the cars are so equipped. Below is a graphical illustration of the progress made in the application of the Automatic Brake to freight cars since its inception



193,168 freight cars fitted with the Westinghouse Automatic Brake, which is nearly 20 per cent. of the Entire Freight Car Equipment of this country.

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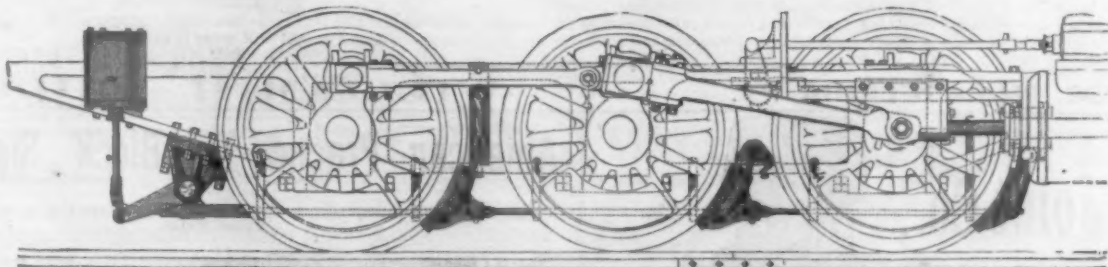
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Standard Outside Equalized Pressure Brake, for two or more pairs of Drivers furnished to operate with either STEAM AIR or VACUUM.

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Manufacturers of McNEIL'S PATENT BALANCED CHARGING BARROW—AUTOMATIC DUMP.

ONE MAN CAN HAUL A TON.

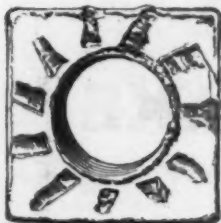
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GENTLEMEN: Referring to your letter of recent date, we would say that we were one of the first to use the McNeil Charging Barrow. In fact we believe we were the first to use them. We now have twenty-four of them and are very well satisfied with them. We can confirm the testimony of Sept. 16, 1890, a copy of which you have in your circular, after two more years' use of the Barrows.
Yours very truly,
OFFICE OF UNION ROLLING MILL CO.,
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We Also Manufacture a Full Line of STEEL WHEELBARROWS for All Purposes.

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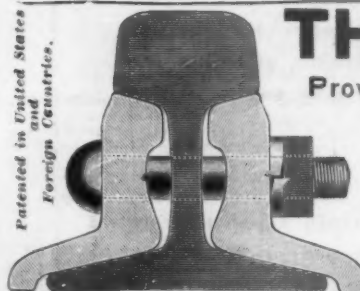
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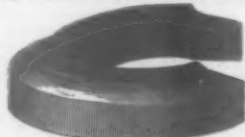
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THE ONLY POSITIVE NUT LOCK IN COMBINATION WITH ELASTICITY.

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These Nut Locks have been adopted by the New England Road-Masters,
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Sample lots furnished for trial, free of expense, by forwarding the distance between centres of fish-plate bolts. Correspondence and orders solicited.

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THE STANDARD COMBINATION TIE PLATE AND BRACE

POSSESSES THE FOLLOWING MERITS:

1. It prevents absolutely the canting of the rail into the tie, thereby greatly increasing the life of the tie.
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4. The plate and brace being made of malleable iron, is practically indestructible.

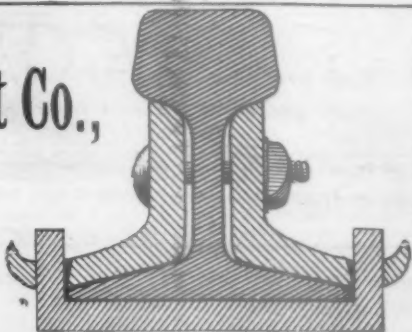
The tie plate and brace is especially useful for curves and grade rails, and also on bridges, whether the rail is laid on ties or on stringers. A tie plate without a brace will not save the head of the spike. A brace without a tie plate will not save the tie, and in a short time the rail will wear into the tie.

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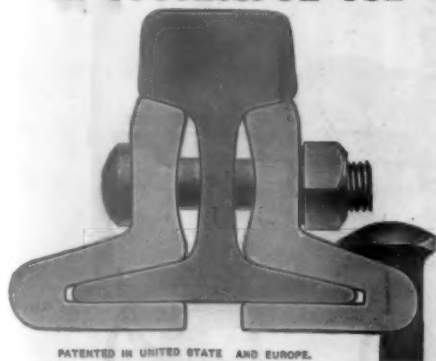
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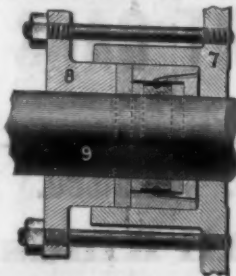
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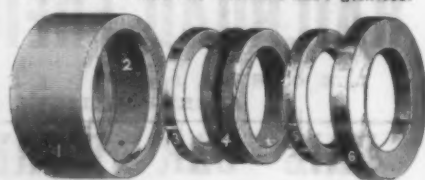
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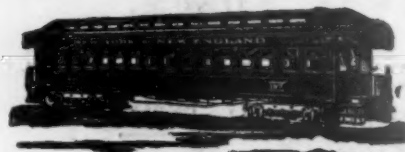
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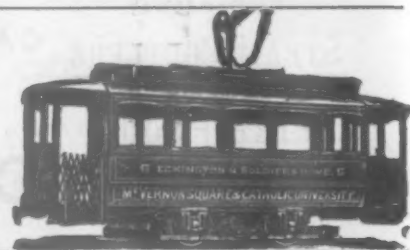
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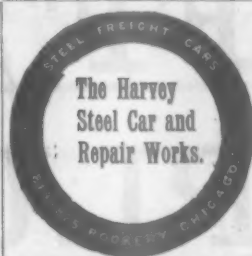
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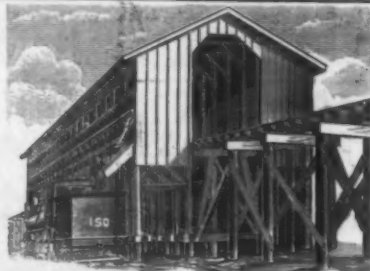
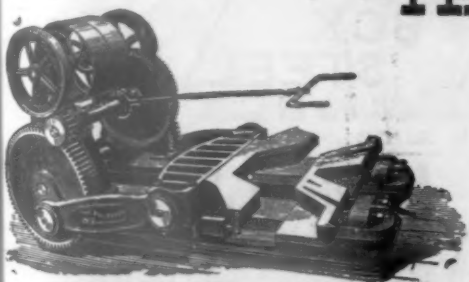
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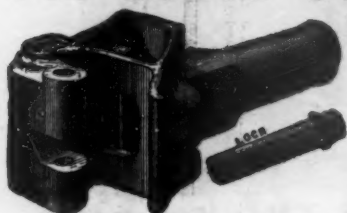
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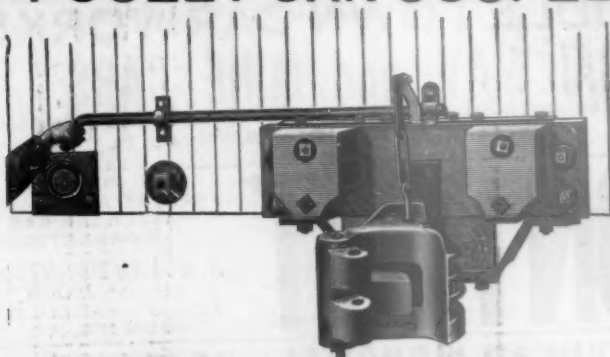
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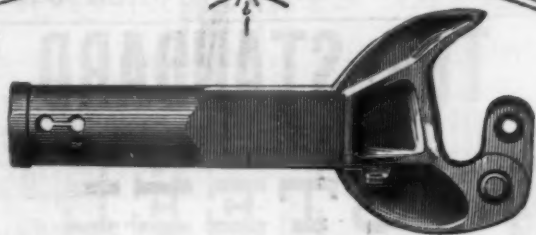
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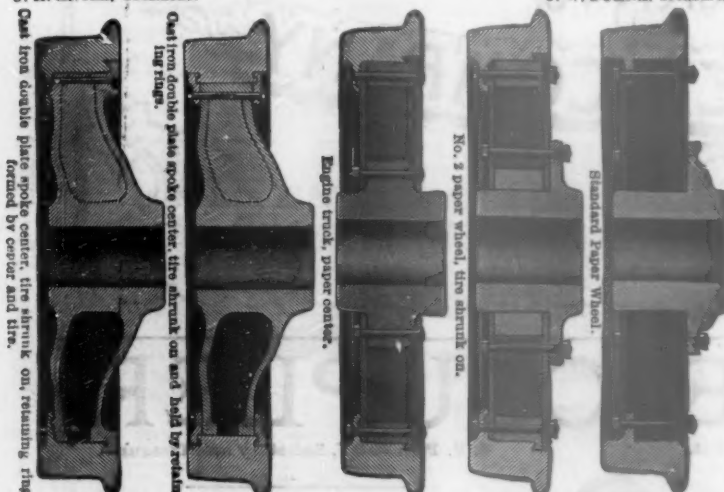
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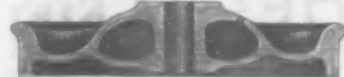
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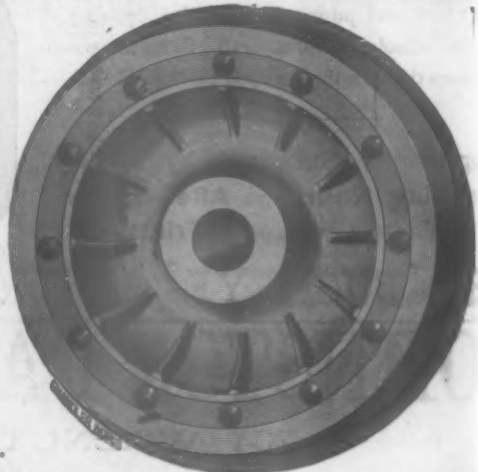
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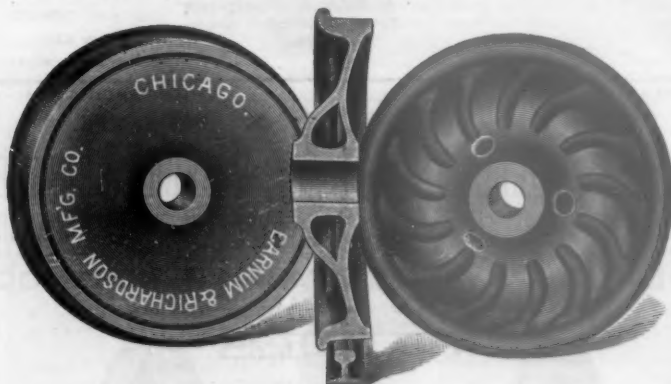
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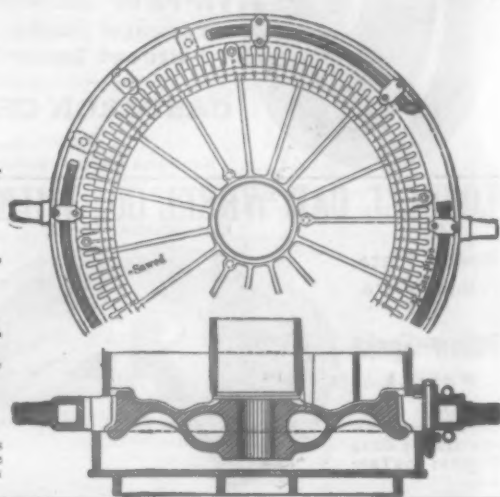
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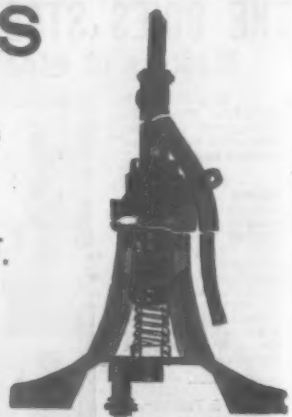
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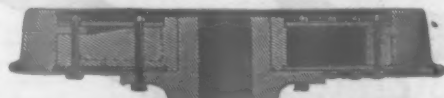
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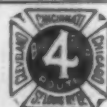
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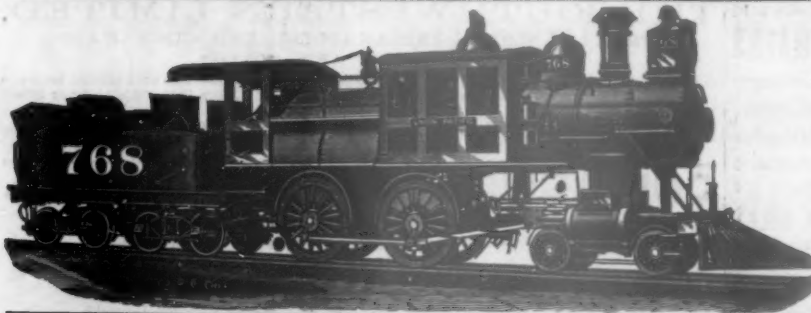


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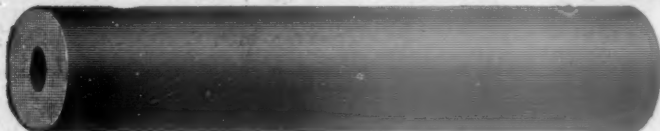
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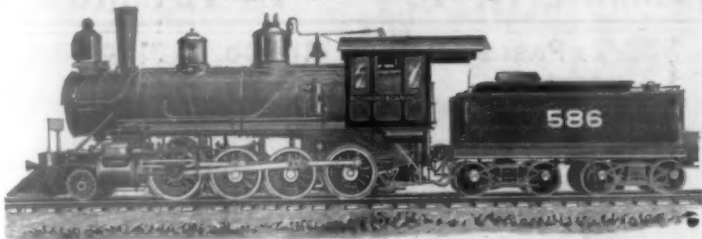
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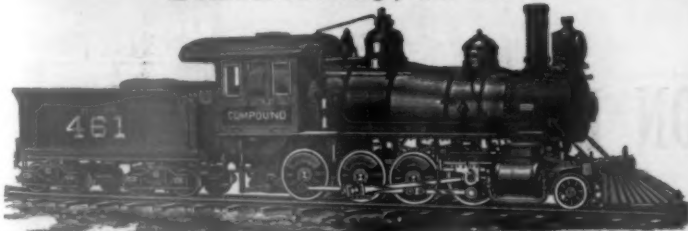
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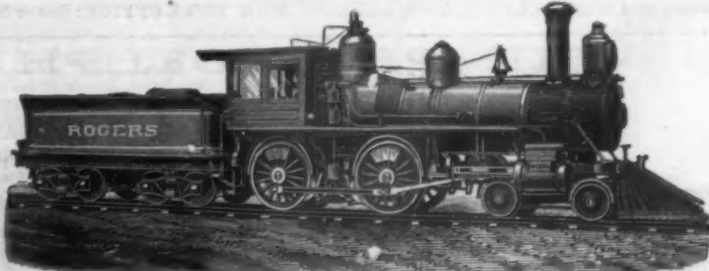
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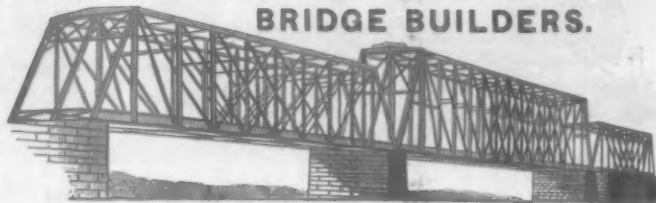
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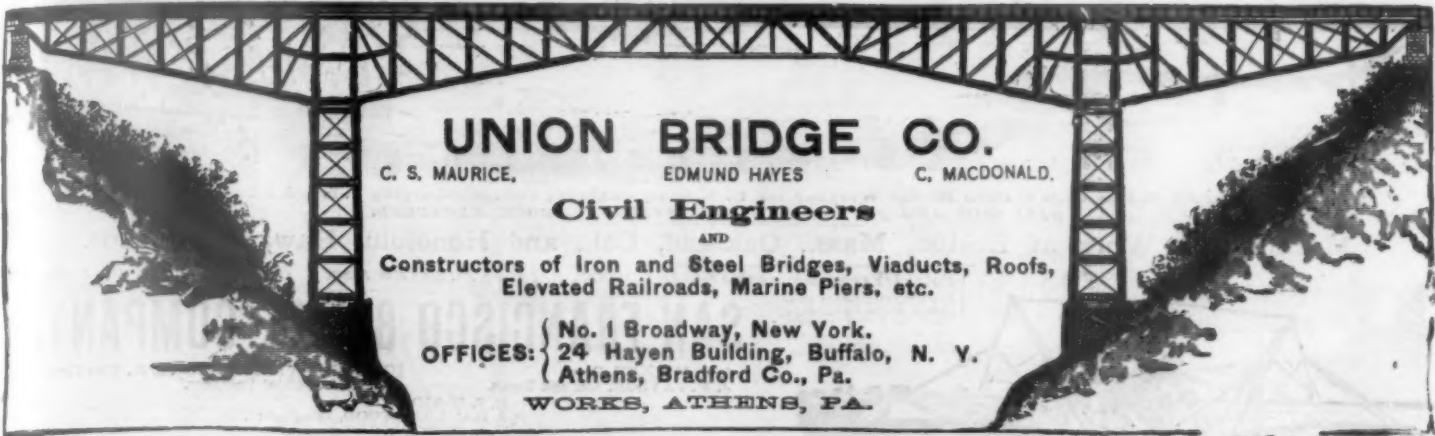
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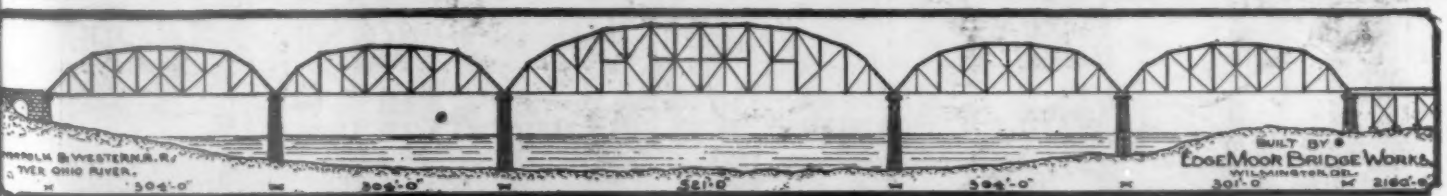
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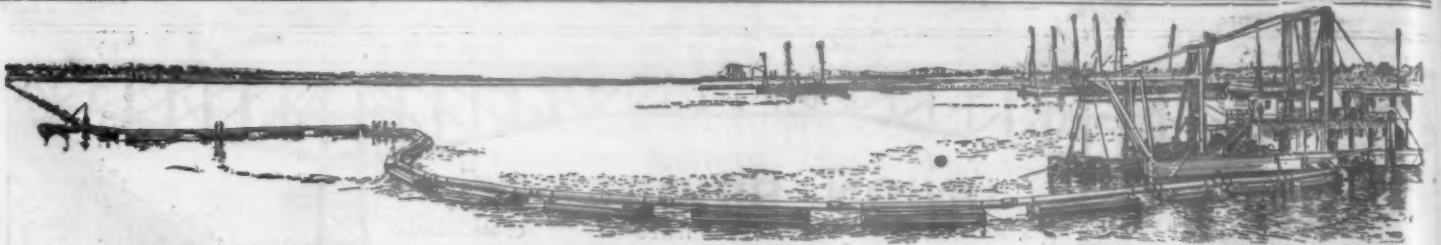


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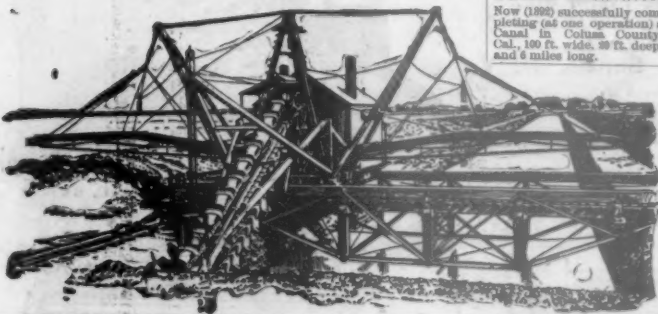
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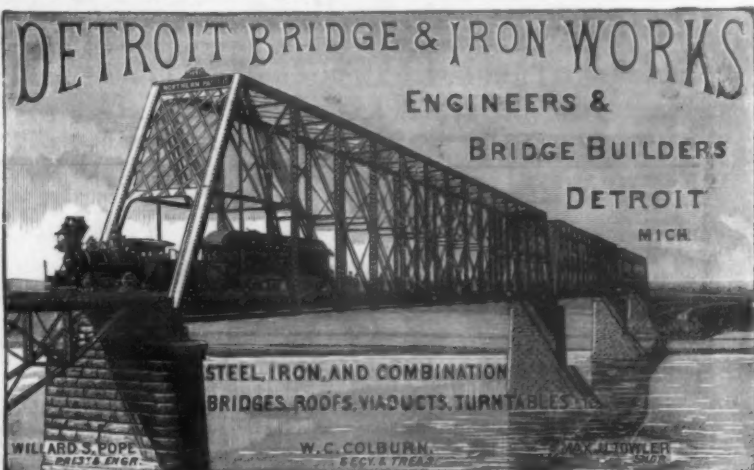
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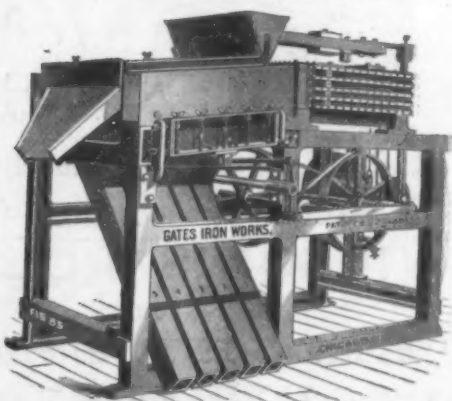
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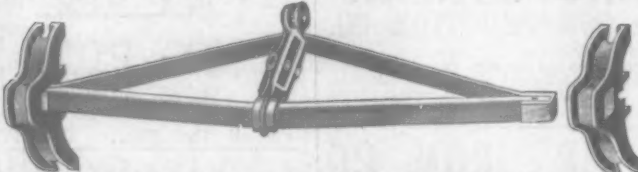
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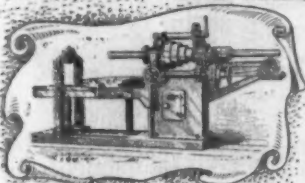
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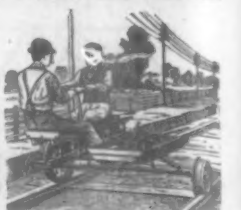
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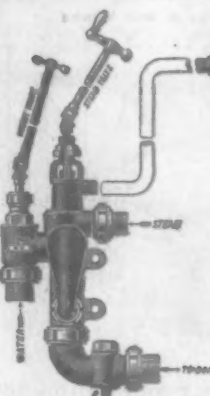


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